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Environmental Geology Report 7
Part 2
1987

# OUTSTANDING SCENIC GEOLOGICAL FEATURES OF PENNSYLVANIA

## PART 2

PENNSYLVANIA GEOLOGICAL SURVEY
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FRONT COVER: Indian Chief Rock (Blair County); sketch from *The Geology of Pennsylvania,* by Henry Darwin Rogers, 1858

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# OUTSTANDING SCENIC GEOLOGICAL FEATURES OF PENNSYLVANIA

## PART 2

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DEPARTMENT OF ENVIRONMENTAL RESOURCES
OFFICE OF RESOURCES MANAGEMENT
BUREAU OF
TOPOGRAPHIC AND GEOLOGIC SURVEY
Donald M. Hoskins, State Geologist

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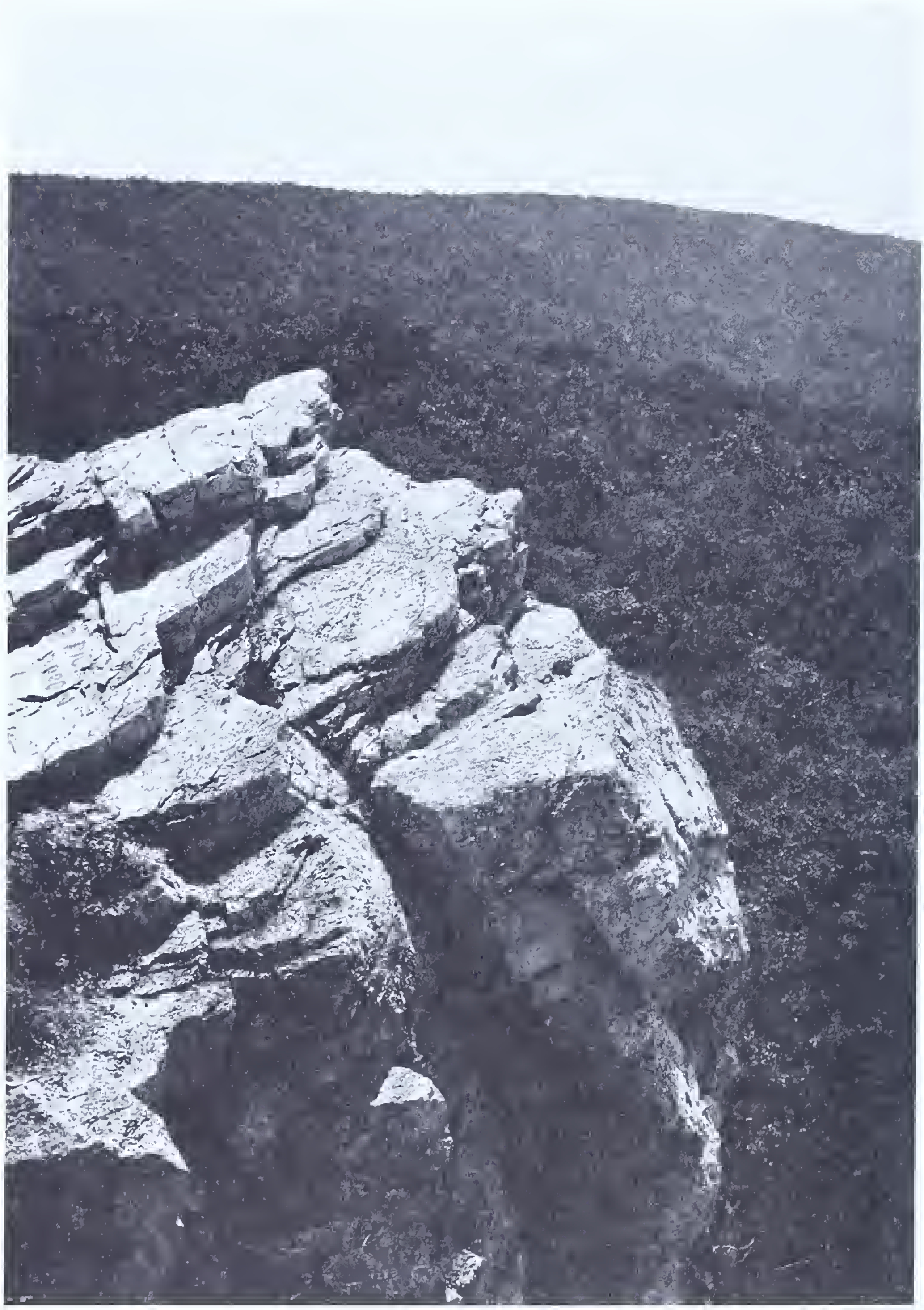
# PREFACE

Scenery has been recognized as a natural resource in the United States since 1864, when the first state park, Yosemite Valley in California, was established. This early recognition related the scenery to outstanding geologic features of the region. Today, even more so than in the past, society recognizes these geologic features as a valuable national resource.

A fascinating geologic story lies behind Pennsylvania's scenery, yet you do not need to be a geologist to appreciate and enjoy the scenic features. Each of the features discussed here and in Part 1, however, represents an area of geologic significance in the Commonwealth where an acquaintance with certain geologic principles can enhance your appreciation of the site.

Since geology and scenery are inseparable, it falls upon the geologist to be the interpreter of the landscape. Because of their outstanding geologic significance, the geologic features described here become outdoor classrooms, places where you can study the earth's surface in an almost natural condition, relatively undisturbed by human activities. Again, keep in mind, it is not necessary to be a geologist to appreciate scenic geological features. Each person should think of these areas as places where one can become acquainted with the processes and products of geologic change; where one can learn to appreciate fully the great age of the earth, its fascinating history, and the complexity of geologic structures and rock composition.



(Photograph by J. P. Wilshusen)

POLE STEEPLE
(Cumberland County)

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# OUTSTANDING SCENIC GEOLOGICAL FEATURES OF PENNSYLVANIA

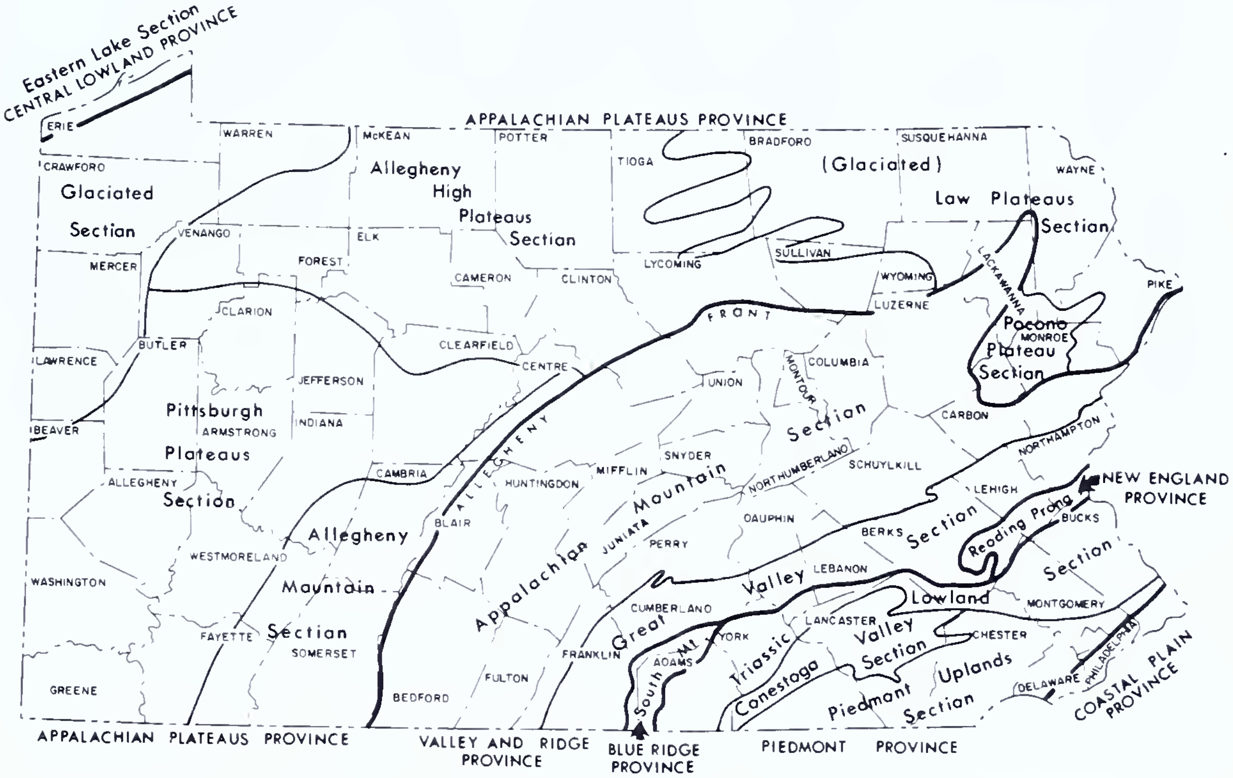
## PART 2

by
Alan R. Geyer and William H. Bolles

# INTRODUCTION

## *PRESENTATION*

In this report, Pennsylvania's outstanding geologic and scenic features have been listed by physiographic province. Every province (or section of a province) has its own characteristic landscape and a related geologic character that is unique to that province; the sum of all the outstanding scenic geological features listed within the province provides an in-depth view of those characteristics. Photographs and sketches are used to illustrate the geologic character of the province, as well as the interrelationship of the landscape with the geology.



PHYSIOGRAPHIC PROVINCES OF PENNSYLVANIA

For each feature, there is a written description and a specific location on a portion of a 7½-minute topographic map published by the U.S. Geological Survey. The topographic map insert is a small portion of the actual sheet but contains identifiers that should enable the viewer to locate the site on the corresponding map. Most of the map inserts are printed at a scale of 1:24,000 (1 inch=2,000 feet); those that are not printed at that scale contain a small rake scale in one corner of the map. Many of the geologic sites described may be found by using a highway map of Pennsylvania. Others, however, may require the use of the appropriate 7½-minute topographic map. Some of the sites are accessible by car, whereas others may require hiking. This may be determined by carefully reading the topographic map to see if a road or trail reaches the area of the feature described.

Part 2, along with Part 1, includes the scenic geological features that, in the opinion of the authors and others, are outstanding. Every effort was made to be as thorough as possible, but the features inventoried herein are not intended to be all-inclusive.

Many unnamed waterfalls and springs, as well as mineral and fossil occurrences, have been omitted because they did not meet the stated criteria of this presentation. Those features may be described in other publications (see "Selected Bibliography"). In addition, caves have been omitted. It is recognized that all caves are outstanding geological features and indescribably scenic, but four Pennsylvania Geological Survey publications (see "Selected Bibliography") contain identifications and descriptions of Pennsylvania caves in greater detail than is possible here.

A glossary of geologic terms has been provided. To better define many of the terms, a small sketch illustrating the definition is included. To facilitate the finding of any individual scenic geological feature, an index is provided. The index is cross-referenced by county (in the table of contents), and alphabetically by subject and by physiographic province (in the back of the book).

## *METHOD OF STUDY*

The search for outstanding scenic geological features of Pennsylvania began with a survey of all county and regional planning commissions; they were asked to identify such areas in their community. In addition, a search was made of all publications on Pennsylvania geology, and each of the 881 quadrangle maps (7½-minute series) was studied. Every location that was identified as a possible scenic geological feature was field checked to determine its validity based upon the following criteria:

1. The site must lend itself to the interpretation or illustration of the geologic heritage of Pennsylvania; i.e., it must be one or more of the following:
    A. A natural feature illustrating geologic processes or geologic formations.
    B. A site having fossil evidence of the development of life throughout geologic time.
    C. A location that illustrates scientific discoveries.
    D. A scenic location characteristic of a physiographic province.
2. The geological feature is of national, state, or local significance.
3. When considered together, the features illustrate the diversity of Pennsylvania's geologic environment.

This search resulted in 1979 in Part 1 of *Outstanding Scenic Geological Features of Pennsylvania*. Since that time, many more features have been brought to the attention of the authors, who carefully investigated each site in the field. The features presented in this volume represent truly outstanding additions.

## *RELATIONSHIP TO PLANNING*

Parts 1 and 2 of *Outstanding Scenic Geological Features of Pennsylvania* provide technical background information for land use planning efforts at all levels of government. Local governments may incorporate the information in their comprehensive plans, zoning ordinances, and subdivision regulations. The information can also be useful for identifying such important geologic and scenic features in national forests, state forests, state parks, state game lands, and other government-owned lands in Pennsylvania. This publication provides an important segment of the base-line information needed for many planning efforts. Therefore, federal, state, and local governmental agencies are encouraged to consider this information when making decisions affecting land use plans and patterns.

## *RELATIONSHIP TO EDUCATION*

With the increasing emphasis on the improvement of science education in the secondary schools, this report provides a much needed resource to better utilize the entire community, including its natural resources, in the planning of programs. An understanding of the earth upon which we live and an awareness of the geologic processes that have resulted in our natural environment are basic elements of scientific knowledge necessary for understanding the numerous environmental problems that exist today. Teachers of Earth Science are aware that "outdoor geological laboratories" provide the most effective means of student learning in regard to how geological processes have operated throughout time and are still taking place today. Even though they are aware of the effectiveness of the study of outdoor locations, it has not been an easy task to locate the best sites to illustrate a particular geological process. It would be a monumental undertaking for individual teachers to conduct a search of the geological literature to find these locations. Parts 1 and 2 of *Outstanding Scenic Geological Features of Pennsylvania* provide a comprehensive listing and description of the best known geological sites by physiographic province.

No matter where the school is located, teachers will be able to find nearby locations that are characteristic of the geology and physiographic province where they live. The utilization of these natural resources can easily be included in the science curriculum of the school. When properly utilized for class study, the local environment of the community provides the fundamental framework upon which learning can take place with regard to the environment and the study of geology. Those geological characteristics, principles, and processes that are illustrated throughout Pennsylvania also carry over to similar locations throughout the nation and the world.

Although these books deal primarily with the geologic significance of the selected sites, the same locations may also be utilized in many other areas of study such as biology, ecology, environmental education, and even social studies and history. These studies may also lead to hobbies and recreational activities which provide lifelong learning experiences.

Awareness and appreciation of our environment are basic to man's resolution of serious environmental problems. If people are to continue to survive on the earth, major problems such as pollution, the disposal of industrial and human waste, the proper handling of pesticides and fertilizers, and the best utilization of our natural resources must receive serious attention, and decisions should be made based upon the best available scientific knowledge. All citizens should appreciate our environment and be aware of the necessity for directed scientific investigation of our environmental problems if we are to solve, or alleviate, the conditions which could seriously affect human life on our planet.

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# SCENIC GEOLOGICAL FEATURES BY PHYSIOGRAPHIC PROVINCE AND SECTION

Where to go and what to see—geologically and scenically—is the theme of this section. Pennsylvania's major highways and secondary roads offer convenient access to most of the outstanding scenic geological features described. Many state and local parks, natural areas, and state forests are oriented around outstanding rock formations of spectacular beauty.

Geologically outstanding features and areas inventoried in this book are those that have a distinctive quality and are of local, state, or national significance. Considered as a group, they illustrate the diversity and grandeur of Pennsylvania's scenery and geology. Although emphasis is placed on the geology of each feature, additional information is provided.

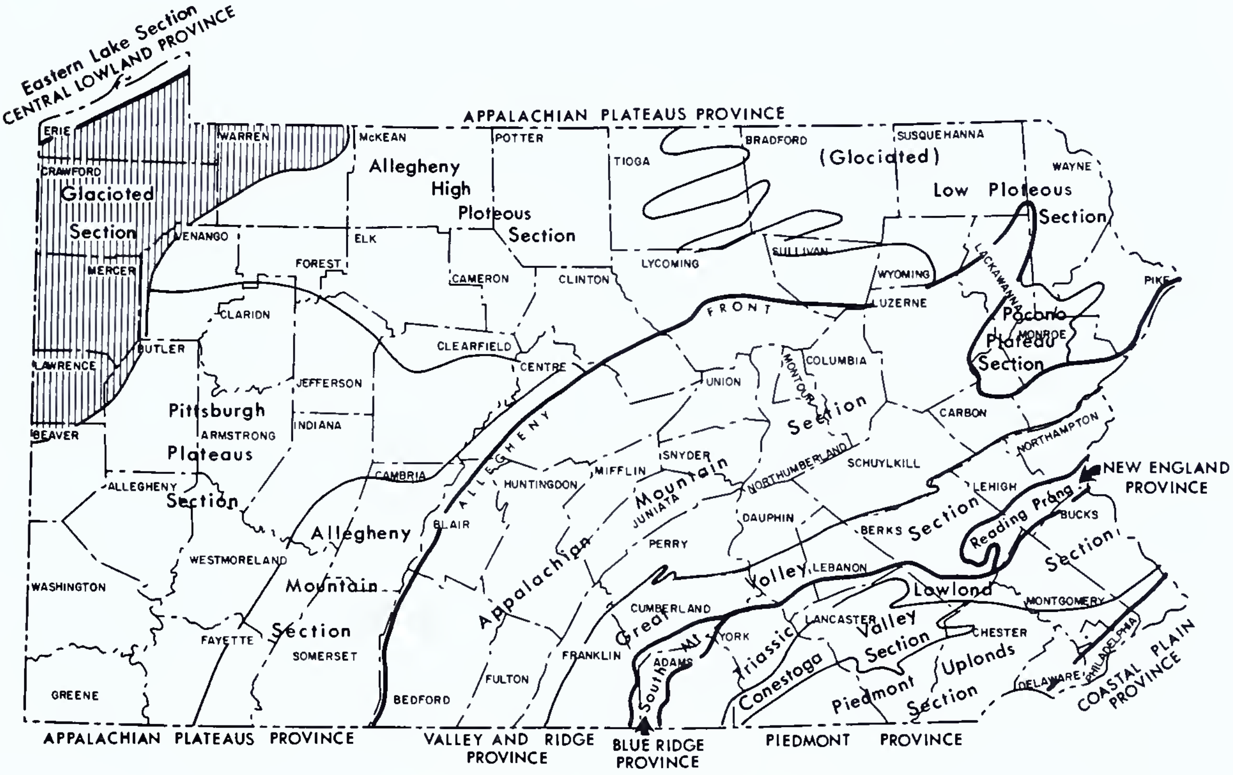
*Please note that the listing of a site does not constitute permission to enter a property or, in the case of publicly owned land, to carry away any natural specimen. Always ask permission from the owners of the land before entering. NEVER TRESPASS.*

# APPALACHIAN PLATEAUS PROVINCE— GLACIATED SECTION

## *TOPOGRAPHY*

The glacial deposits lie north of a line from Ellwood City in Beaver County to near the center of the northern boundary of Butler County. The land surface vividly shows such features of glaciation as terminal moraines, kettle lakes, swamps, eskers, drumlins, and kame terraces. Local relief is greatly subdued.

Dendritic drainage patterns are characteristically developed on the nearly horizontal beds of rock. However, due to modification from glaciation, crude radial and trellis patterns can be locally found.



## *GLACIAL DEPOSITS*

Northwestern Pennsylvania is covered with deposits of drift carried by the continental ice sheets. Tills of the various ice advances are identified and separated on the basis of leaching, texture, color, and soil-profile development and are treated as rock units. A table of the ice advances, geologic units, and composition follows:

| | NAME OF ADVANCE | GEOLOGIC UNIT | TYPE OF SEDIMENT |
|---|---|---|---|
| Wisconsinan | Ashtabula | End moraine | Silt-rich till |
| | Hiram | End moraine | Clay-rich till |
| | | Ground moraine | Clay-rich till |
| | Lavery | End moraine | Silt-rich till |
| | | Ground moraine | Silt-rich till |
| | Kent | End moraine | Till |
| | | Recessional moraine | Till |
| | | Ground moraine | Till |
| Illinoian | Undifferentiated units | Kames, outwash, and lake deposits | Sand, gravel, and till |
| | | Ground moraine | |

## ROCK COLUMN

The bedrock in the Glaciated section does not have a uniform character. The reason for this diversity in rock characteristics is that in the past the area was a coastal plain complete with deltas, sandbars, lagoons, stream channels, marginal swamps, and other coastal features. Because of the lack of a uniform depositional environment over the whole area, the rock types are the result of local conditions at a given time. No one rock unit is consistent throughout the whole area, and each specific locality has its own individuality.

A detailed description of the rock units is presented below:

| SYSTEM | ROCK UNIT | DESCRIPTION |
|---|---|---|
| Quaternary | Alluvium | Sand and gravel deposited in and along streams. |
| | Glacial deposits | Gravel varying in the amount of clay and sand and in pebble size. |
| Pennsylvanian | Conemaugh Group | Mostly shale and sandstone and some limestone; sandstone can be massive; lesser coal beds; Mahoning sandstone commonly occurs at base. |
| | Allegheny Group | Alternating shale and sandstone; also contains limestone, clay, and major coal beds; Vanport Limestone is used as a marker bed. |
| | Pottsville Group | Sandstone occurring as thick units such as the Homewood and Connoquenessing sandstones; some coal, shale, clay, and limestone. |

| SYSTEM | ROCK UNIT | DESCRIPTION |
|---|---|---|
| Mississippian | Shenango Formation | Three sandstone intervals separated by shale interbedded with thin siltstone and sandstone. |
| | Cuyahoga Group | Interbedded sandstone, siltstone, and shale. |
| | Meadville Shale | Shale and some beds of siltstone. |
| | Sharpsville Sandstone | Sandstone, shale, and siltstone. |
| | Orangeville Shale | Soft gray shale containing scattered sandstone and siltstone beds. |
| | Corry and Berea Formations | Crossbedded sandstone, light-colored, fine-grained. |
| | Bedford Shale | Shale; some siltstone. |
| | Cussewago Sandstone | Sandstone, fine- to very fine grained; interbeds of siltstone and shale. |
| Upper Devonian | Riceville and Oswayo Formations | Shale and siltstone. |
| | Venango Formation | Red, gray, and brown shale and sandstone; includes Venango sands and Salamanca sandstone and conglomerate. |
| | Chadakoin Formation | Alternating shales and sandstones, fine-grained, gray, fossiliferous. |
| | Girard Shale | Ashen-gray shale; uniform texture. |

## *ROCK STRUCTURE*

The rocks form broad, shallow synclines and anticlines that trend in a northeast-southwest direction for hundreds of miles. This broad, wavy folding cannot be seen from any point on the ground, but must be looked at on a regional basis. The scale is in miles, not feet or inches. Within the broad structures are minor folds that also can be traced for miles. Geologic and structural maps show these folds.

# 390. GRANT CITY FALLS

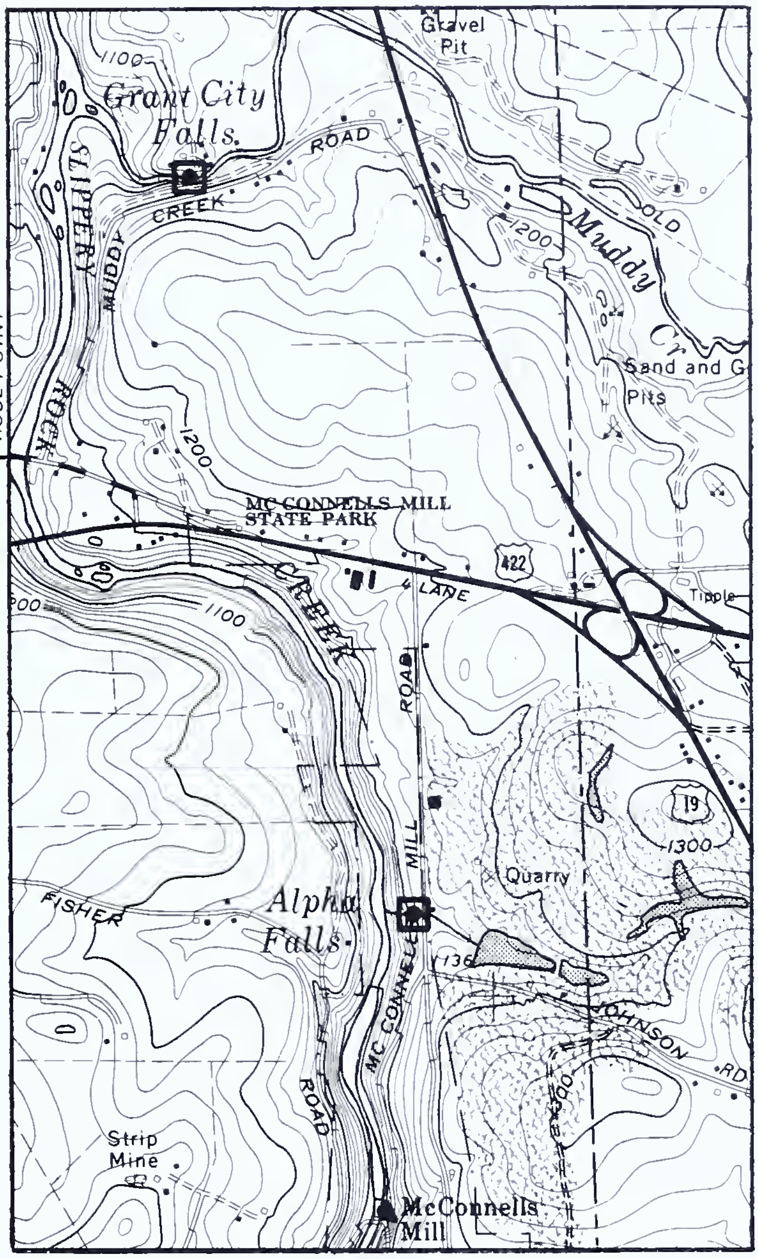
COUNTY: Lawrence TOWNSHIP: Slippery Rock

QUADRANGLE: Portersville

LOCATION: Along Muddy Creek Road near the mouth of Muddy Creek, about 0.8 mile northeast of the village of Rose Point.

REMARKS: The retreat of the glacial ice from the western end of large glacial lakes opened many outlets to the south; Muddy Creek pass was one of these outlets. Water rushed through the pass, eroding the land and deepening the gorge at McConnells Mill. The outlet of Muddy Creek into Slippery Rock Creek has been worn down about 40 feet in postglacial time; this

GRANT CITY FALLS



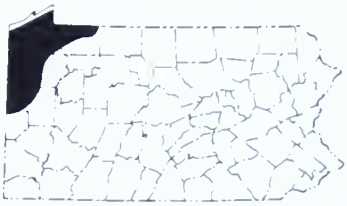
outlet is a hanging valley which has a very scenic waterfall, Grant City Falls, known also as **Muddy Creek Falls**. A few lesser cascades occur between this falls and Slippery Rock Creek.

**Alpha Falls** (391), located about 1.3 miles south in McConnells Mill State Park, has a similar origin but is not as spectacular; it has only a small stream and little water plunging about 50 feet over flat-lying sandstone.

## 390. GRANT CITY FALLS *(continued)*

ALPHA FALLS

REFERENCE: Bushnell, Kent [1975], *McConnells Mill State Park — Slippery Rock Creek Gorge,* Pennsylvania Geological Survey, 4th ser., Park Guide 9, pamphlet.



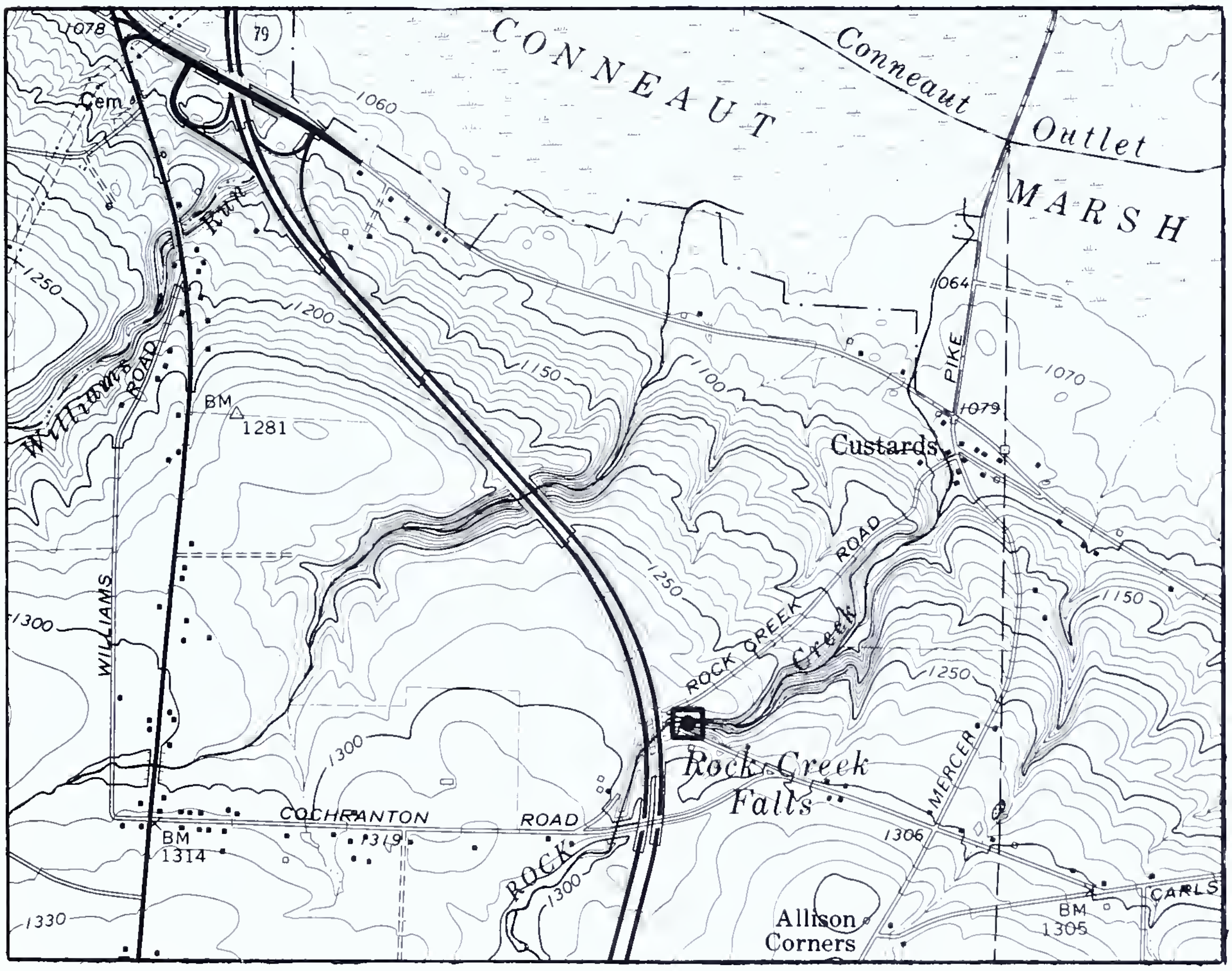
## 392. ROCK CREEK FALLS

COUNTY: Crawford TOWNSHIP: Greenwood

QUADRANGLE: Geneva

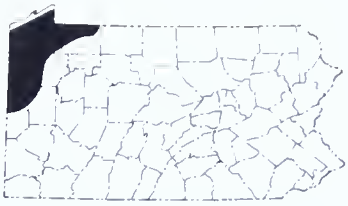
LOCATION: At the intersection of Interstate Route 79 and Rock Creek Road, 0.5 mile northwest of Allison Corners; along Rock Creek.

REMARKS: The falls occurs at the head of a highly scenic, rock-walled gorge; Rock Creek tumbles in a single fall of about 20 feet. Flat-lying resistant sandstone layers (Shenango Formation, Mississippian age) cap the top of the falls; less resistant shale (Meadville Shale,



## 392. ROCK CREEK FALLS *(continued)*

Mississippian age) has been eroded away beneath the sandstone caprock.



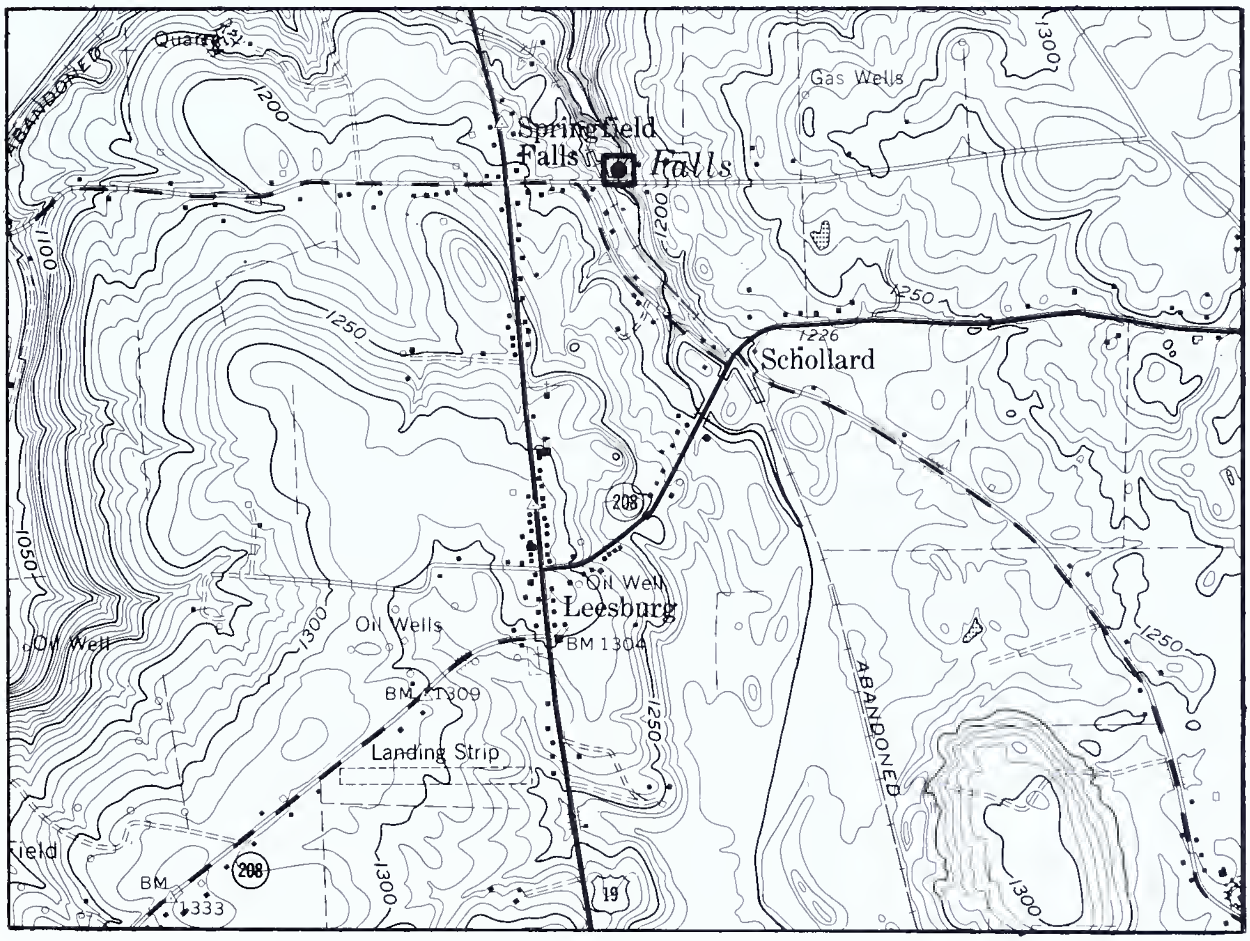
# 393. SPRINGFIELD FALLS

COUNTY: Mercer TOWNSHIP: Springfield

QUADRANGLE: Mercer

LOCATION: Approximately 0.8 mile north of Leesburg, at the village of Springfield Falls; in State Game Lands No. 284.

REMARKS: A tributary to Neshannock Creek cascades about 60 feet over flat-lying layers of sandstone (Connoquenessing Formation, Pennsylvanian age). The falls is highly picturesque and has several large, tablelike rocks at the top from which the visitor may view the area.

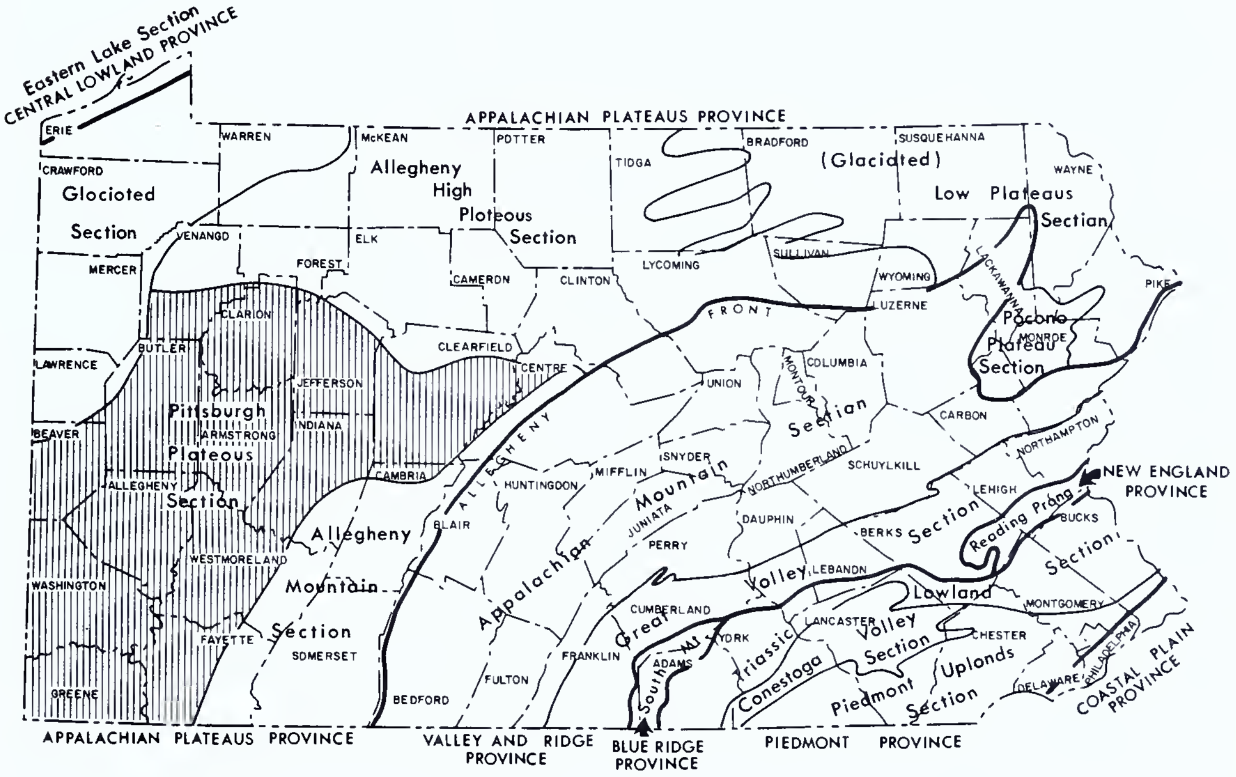


## 393. SPRINGFIELD FALLS *(continued)*

# APPALACHIAN PLATEAUS PROVINCE—PITTSBURGH PLATEAUS SECTION

## *TOPOGRAPHY*

The Pittsburgh Plateaus section is characterized by rounded hills and open valleys. From Washington northward to Pittsburgh the undulating uplands reach elevations between 1,200 and 1,250 feet above sea level. Hill summits are generally accordant, and local relief is between 250 and 350 feet. Southward and westward from Washington the ridges become sharp-featured and increase in elevation to a maximum of about 1,600 feet in Greene County.



## *ROCK COLUMN*

The rocks are mostly shale, siltstone, sandstone, and conglomerate. The Mississippian, Pennsylvanian, and Permian Systems contain limestones in minor amounts. Shale is the most common rock type of the section, making up more than 50 percent of the entire rock sequence.

A description of the rock units follows:

| SYSTEM | ROCK UNIT | DESCRIPTION |
|---|---|---|
| Quaternary | Stream alluvium | Sand, gravel, silt, and clay. |
| | Terrace deposits | Sand, clay, and gravel on terraces above present rivers; includes the Carmichaels Formation. |
| Permian | Greene Formation | Soft shale; claystone; thin shaly sandstone; shaly limestone. |
| | Washington Formation | Light-gray sandstone; gray shaly limestone; some shale, claystone, and thin coals. |
| Permian and Pennsylvanian | Waynesburg Formation | Sandstone, shale, and limestone; some minable coals. |
| Pennsylvanian | Monongahela Group<br>Uniontown Formation<br>Pittsburgh Formation | Limestone; light-gray sandstone; dark-gray shale; some minable coals. |
| | Conemaugh Group<br>Casselman Formation<br>Glenshaw Formation | Some shaly gray limestone; numerous poor-quality coals; gray shale; coarse-grained sandstone. |
| | Allegheny Group | Several minable coals; major sandstone units; some shale, claystone, and limestone. |
| | Pottsville Group | Sandstone and shale; contains some conglomerate; locally, minable coals. |
| Mississippian | Mauch Chunk Formation | Red shale, siltstone, and sandstone. |
| | Burgoon Sandstone | Sandstone, conglomerate, siltstone, and shale. |
| | Shenango Formation | Three sandstone intervals separated by shale interbedded with thin siltstone and sandstone. |

## *ROCK STRUCTURE*

The major structural feature is the broad, shallow, spoon-shaped depression that lies between Cincinnati on the west and Chestnut Ridge on the east. The deepest part of the trough lies in southwestern Greene County. Northward and southward the axis rises gently, so that successively older formations crop out in concentric bands around the center of the depression.

Superposed upon this trough are a number of secondary folds, which in the western half of the trough are very gentle but toward the east become progressively deeper and closer.

Exposures of faults are lacking. Subsurface drilling for natural gas, however, has proved that faulting of considerable magnitude occurs at depth. Surface evidence of minor faulting has been noted.

APPALACHIAN PLATEAUS PROVINCE

PITTSBURGH PLATEAUS SECTION

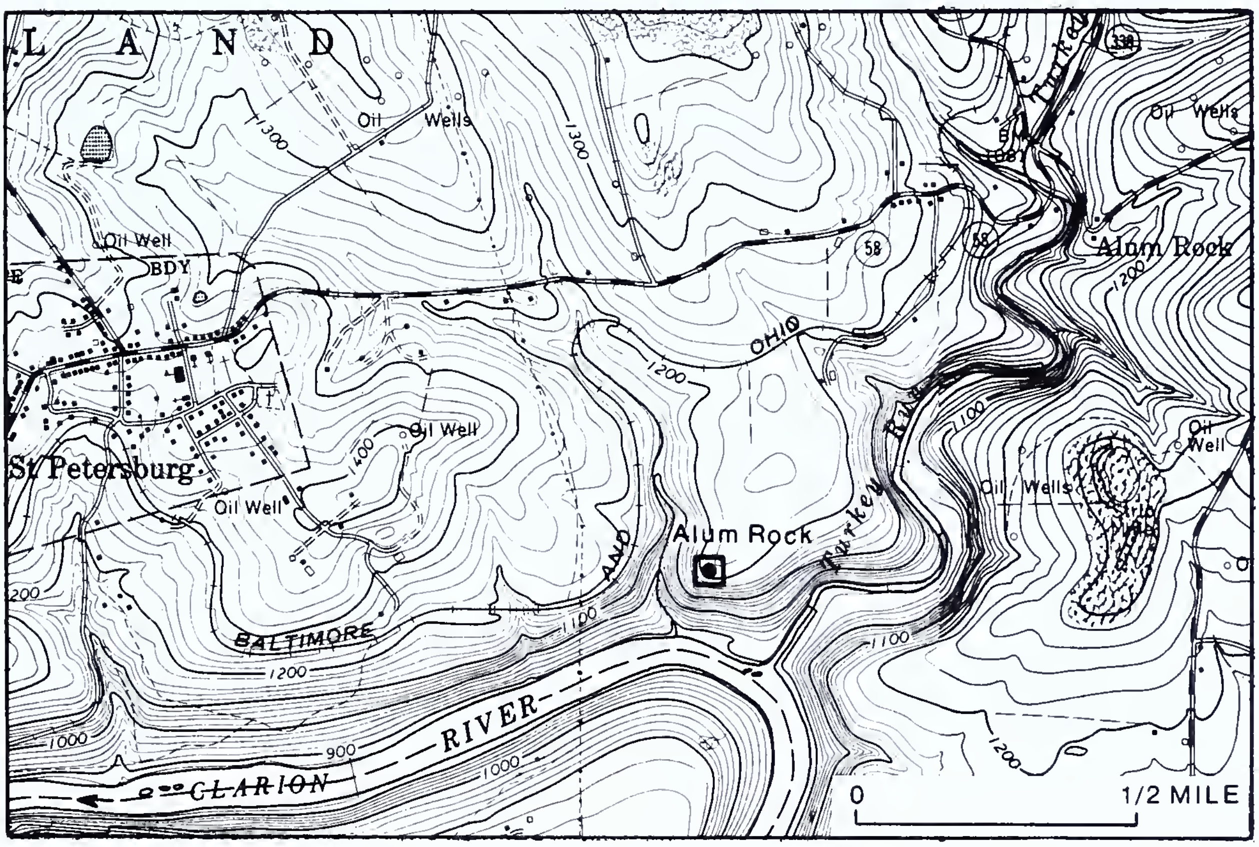
# 394. ALUM ROCK

COUNTY: Clarion TOWNSHIP: Richland

QUADRANGLE: Emlenton

LOCATION: Approximately 1 mile southwest of the village of Alum Rock (named for the geologic feature); adjacent to Pa. Route 58 and the Clarion River.

REMARKS: This large outcrop of light-gray sandstone and conglomerate (Pottsville Group, Pennsylvanian age) at the top of a cliff above the Clarion River is by far the best overlook in the Pittsburgh Plateaus section. The beauty, serenity, and remoteness make this truly a magnificent dot on Pennsylvania's landscape. Judging from the rock carvings, this must have been a favorite spot over many years.



## 395. HOMEWOOD FALLS

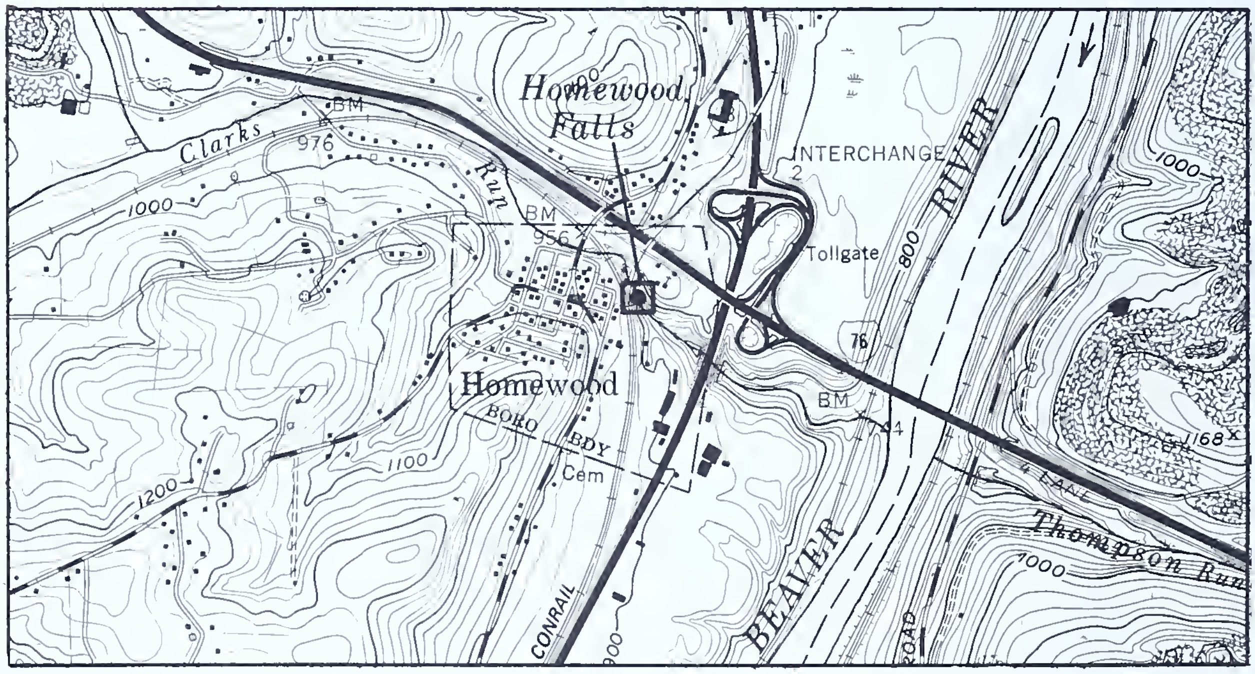
COUNTY: Beaver TOWNSHIP: Homewood

QUADRANGLE: Beaver Falls

LOCATION: East of the intersection of Clarks Run and old Pa. Route 18 in the borough of Homewood; just beneath a railroad spur over Clarks Run.

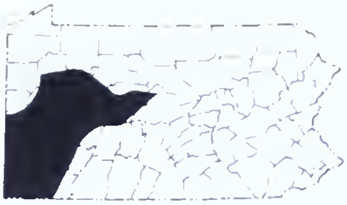
REMARKS: Clarks Run passes over massive layers of the Homewood Sandstone (Pennsylvanian age), creating an extremely scenic 30-foot-high falls; smaller falls and cascades occur downstream in Clarks Run between this site and the Beaver River. A semicircular rock cliff and large plunge pool add to the beauty of the area.

REFERENCE: DeWolf, F. W. (1929), *New Castle quadrangle—Geology and mineral resources,* Pennsylvania Geological Survey, 4th ser., Atlas 5, 238 p.



# APPALACHIAN PLATEAUS PROVINCE

## PITTSBURGH PLATEAUS SECTION



# 396. ROCKS AT CURWENSVILLE LAKE

COUNTY: Clearfield TOWNSHIP: Pike

QUADRANGLE: Curwensville

LOCATION: Along Pa. Route 969, 3 miles southwest of Curwensville; along the west side of Curwensville Lake.

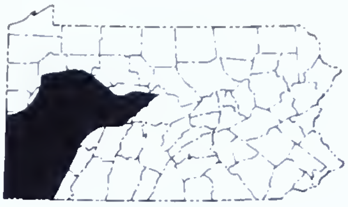
REMARKS: This site represents the best example of the discontinuous rock layers that are typical of the Pennsylvanian-age rocks in western Pennsylvania. The variable bedding dips and rock thicknesses are due to paleotopography (ancient topography), interrupted and uneven deposition of original sediments (differential sedimentation), and differential compaction.

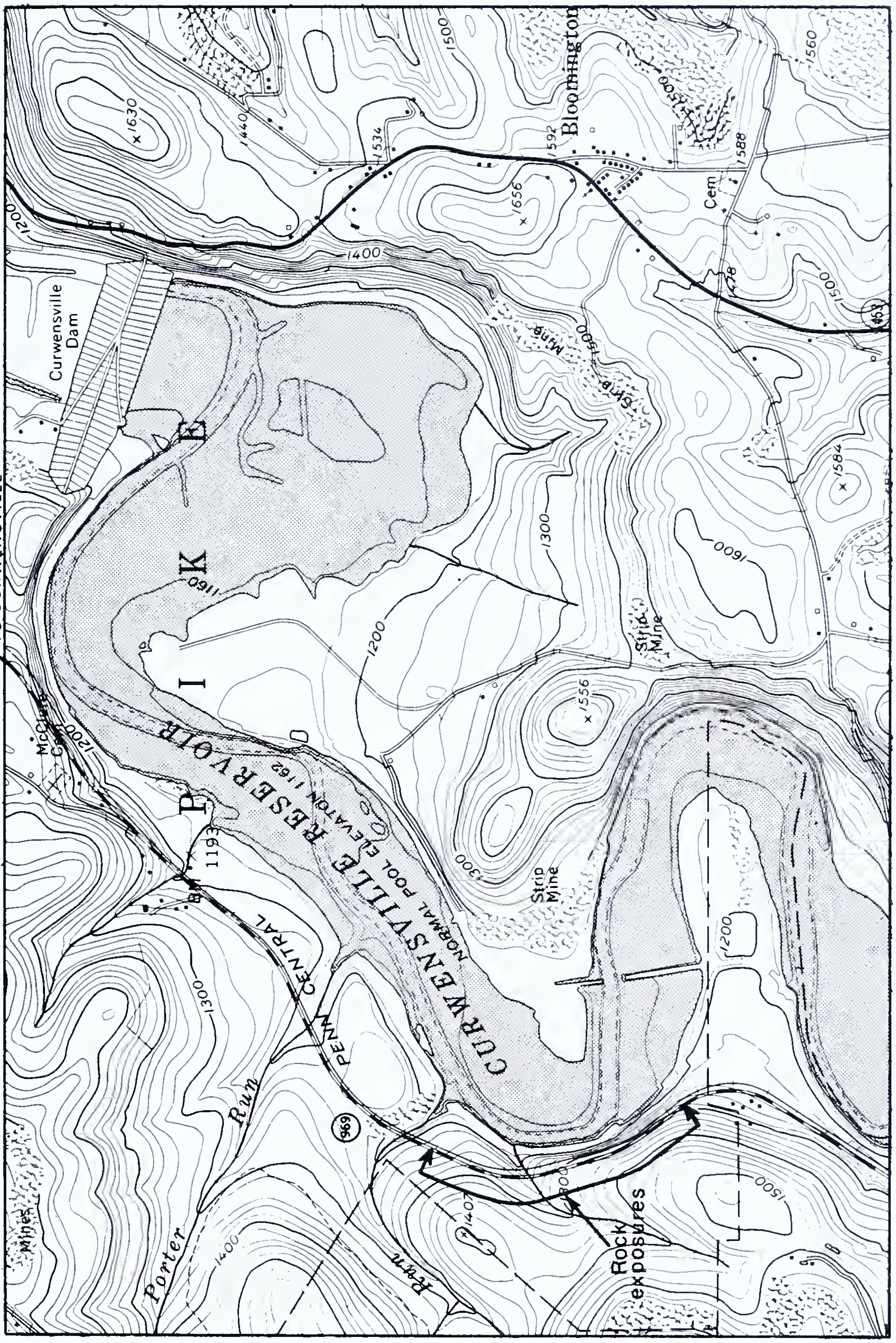
This is the only known location where genetic relationships between the Mercer high-alumina flint clay and surrounding rocks can be interpreted. The Mercer clay is a unique economic mineral deposit whose origin has generated controversy for years.

REFERENCES: Edmunds, W. E., and Berg, T. M. (1971), *Geology and mineral resources of the southern half of the Penfield 15-minute quadrangle, Pennsylvania,* Pennsylvania Geological Survey, 4th ser., Atlas 74cd, 184 p.

Foose, R. M. (1944), *High-alumina clays of Pennsylvania,* Economic Geology, v. 39, p. 557–577.

Williams, E. G., and Bragonier, W. A. (1974), *Controls of Early Pennsylvanian sedimentation in western Pennsylvania,* in Briggs, Garrett, ed., *Carboniferous of the southeastern United States,* Geological Society of America Special Paper 148, p. 135–152.




TO CURWENSVILLE
Curwensville Dam
CURWENSVILLE RESERVOIR
NORMAL POOL ELEVATION 1162
P
I
K
E
Bloomington
Cem
McClure Cem
Strip Mine
Strip Mine
Strip Mine
PENN CENTRAL
Porter Run
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Rock exposures
969
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1630
1440
1534
1500
1592
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1560
1656
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1600
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1556
1193
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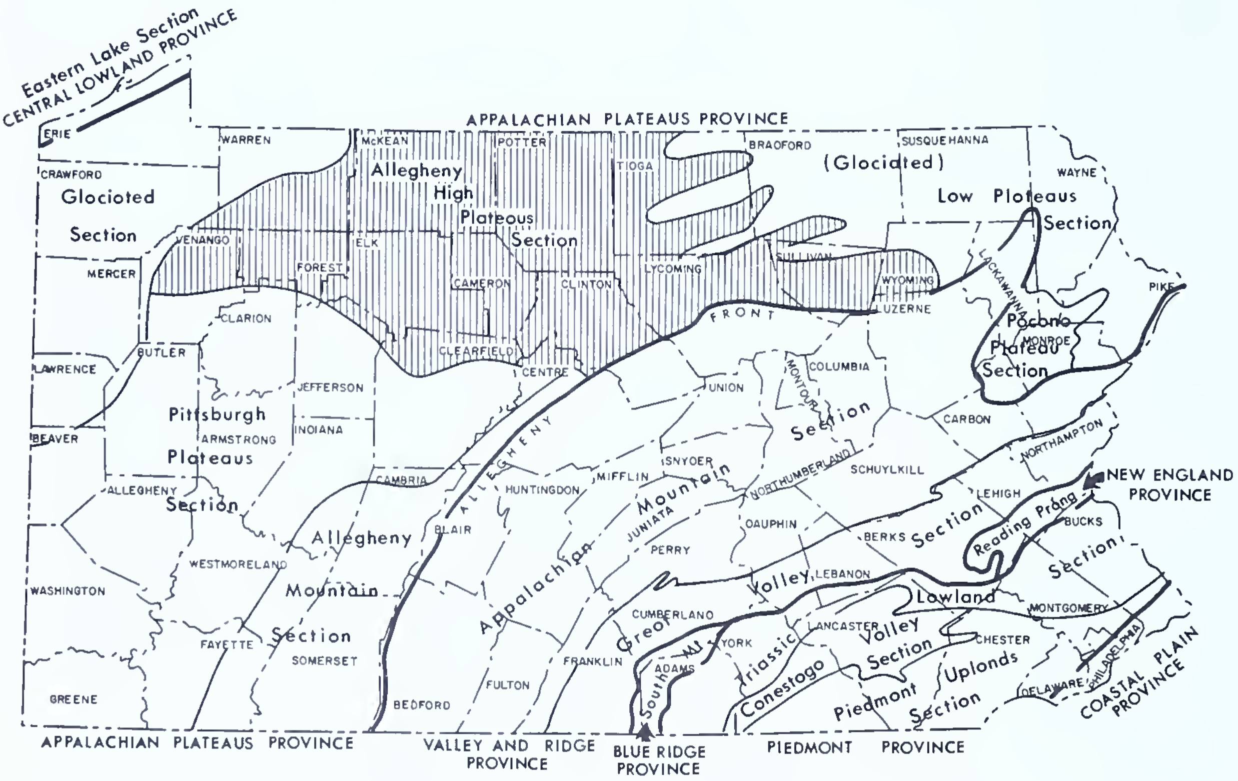
1500

# APPALACHIAN PLATEAUS PROVINCE— ALLEGHENY HIGH PLATEAUS SECTION

## *TOPOGRAPHY*

The Allegheny High Plateaus section is a very rugged, high plateau, deeply dissected by numerous streams. For example, the relief along Sinnemahoning Creek, one of the principal tributaries of the West Branch of the Susquehanna River, exceeds 1,000 feet, and the total relief of the section exceeds 1,600 feet. Valley walls tend to be steep along major streams and numerous "hollows" and also exist where smaller streams have cut through the rocks. The hills have been rounded by erosion, but slopes are nevertheless steep. During heavy rains, stream levels rise very fast due to either the absence of floodplains or the short lateral extent of floodplains that do exist.

The highest point in the section is located east of Kapel Hill in Summit Township, Potter County. This location is approximately 2,550 feet above sea level.



## *ROCK COLUMN*

The rocks present are shale, siltstone, sandstone, and some conglomerate. No limestones occur in the Devonian rocks, but the Pennsylvanian System

contains some in minor amounts. Shale is the most common rock type in the section.

| SYSTEM | ROCK UNIT | DESCRIPTION |
|---|---|---|
| Pennsylvanian | Conemaugh Group | Some shaly gray limestone; numerous poor-quality coals; gray shale; coarse-grained sandstone. |
|  | Allegheny Group | Sandstone, conglomerate, shale, fireclay, slate, and numerous coal beds. |
|  | Pottsville Group | Hard coarse quartz conglomerate; white and gray sandstone; brown sandstone and a few thin seams of coal. |
| Mississippian | Mauch Chunk Formation | Gray and green sandstone; red shale, siltstone, and claystone. |
|  | Burgoon Sandstone | Light-gray to greenish-gray sandstone; occasional shale and siltstone; a few coal beds. |
|  | Shenango Formation | Sandstone, shale, and some siltstone. |
|  | Cuyahoga Group | Shale and siltstone; some sandstone. |
| Mississippian and Devonian | Huntley Mountain Formation | Sandstone, shale, and siltstone, greenish- or olive-gray; sandstones are thin and flaggy. |
| Devonian | Oswayo Formation | Greenish-gray sandstone; minor shale units. |
|  | Venango and Catskill Formations | Red, gray, and brown shale and sandstone (Venango); red shale, sandstone, conglomerate, and siltstone (Catskill). |
|  | Chadakoin Formation | Alternating shales and sandstones; fine-grained, gray, fossiliferous. |
|  | Lock Haven Formation | Interbedded shale, sandstone, siltstone, mudstone, and minor conglomerate; olive-gray to olive-brown, fossiliferous. |

## *ROCK STRUCTURE*

The major structural features of the section are three synclines, the axes of which trend N30–35°E and which have shallow plunges that terminate their surface expression. From north to south across Bradford County, they are the Windham syncline, Blossburg syncline, and Barclay syncline. All of the folds die out to the east and the rocks become nearly horizontal.

Surface evidence of major faulting is lacking. Drilling in Tioga County has shown, however, that faulting of considerable dimensions has occurred at depth.

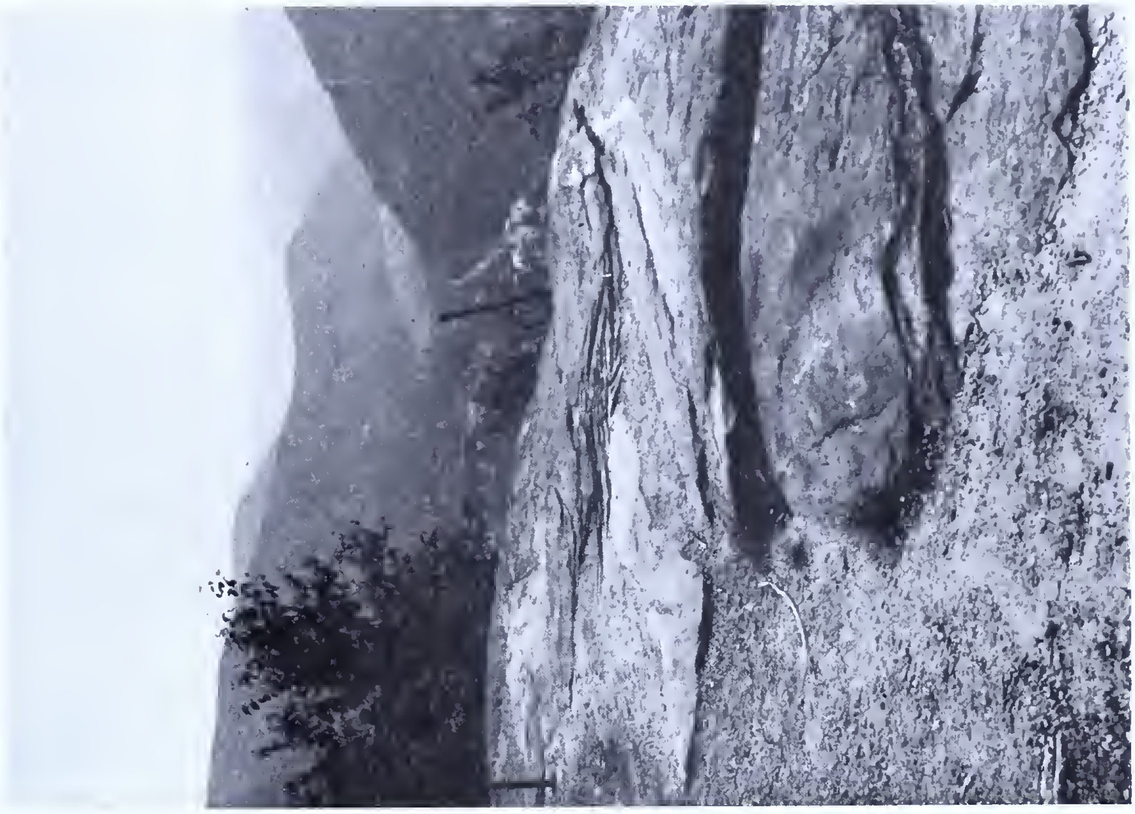
# 397. BAND ROCK

COUNTY: Lycoming TOWNSHIP: McIntyre

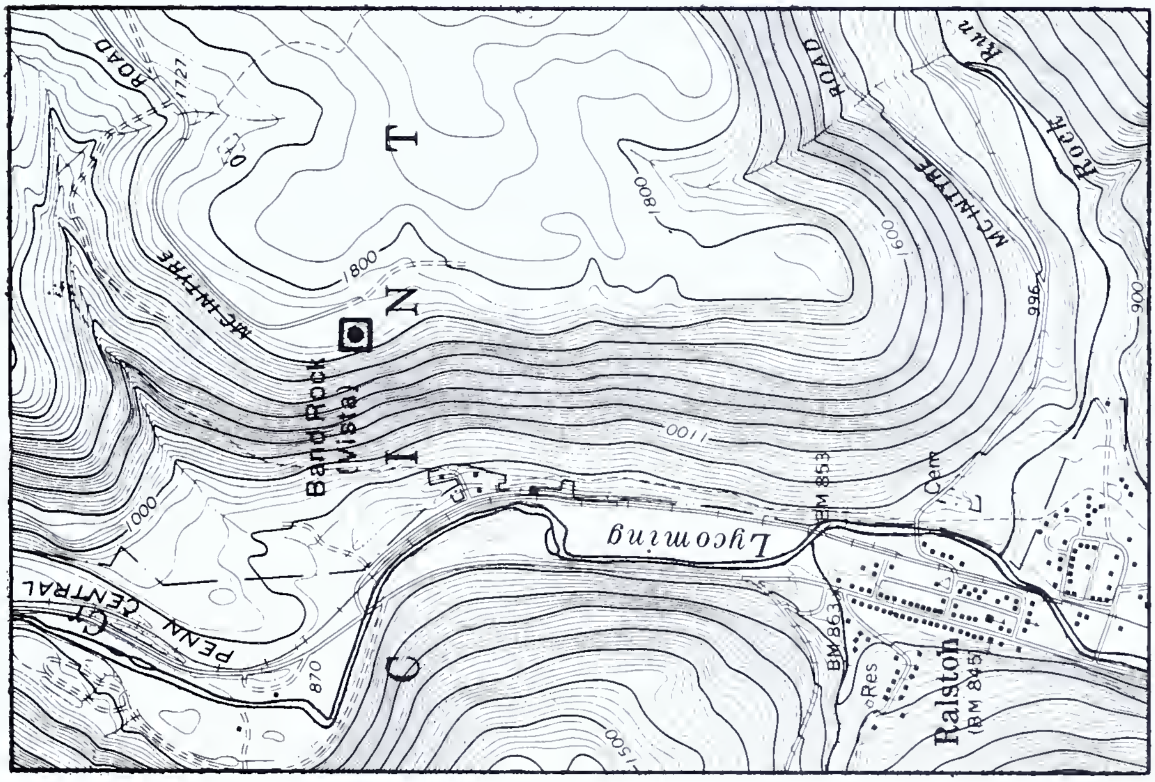
QUADRANGLE: Ralston

LOCATION: About 1.2 miles northeast of the village of Ralston; in Tiadaghton State Forest, at the end of McIntyre Road.

REMARKS: Also known as **Bandstand Rock,** this site provides one of the most outstanding vistas in the Commonwealth, a magnificent view of the High Plateau dissected by Lycoming Creek. Large flat slabs of sandstone (Pottsville Group, Pennsylvanian age) are exposed on the edge of the cliff overlooking Ralston. Townsfolk from a nearby coal mining community (now gone) built a wooden platform on this rock in the 1890's to serve as a bandstand. Each Sunday for about 15 years a small band played on the platform; it is said that the entire valley below heard and enjoyed the music.



BAND ROCK


Band Rock
(Vista)
McINTYRE
ROAD
McINTYRE
ROAD
Lycoming
Rock
Run
PENN CENTRAL
Ralston
(BM 845)
BM 853
BM 863
Res
Cem
T
N
I
C
1800
1800
1600
1100
1000
1500
1727
870
996
900

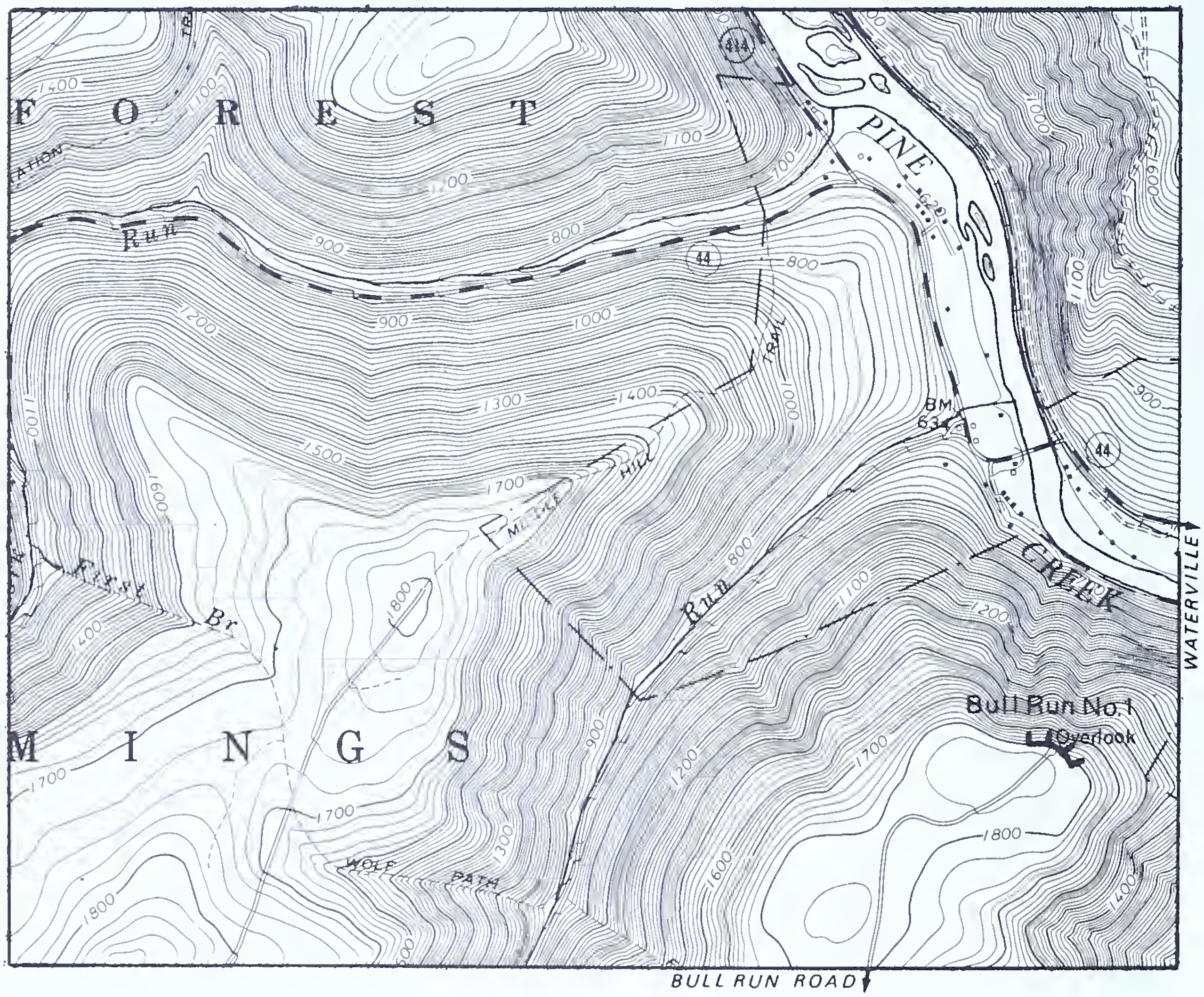
# 398. BULL RUN OVERLOOKS

COUNTY: Lycoming TOWNSHIPS: Cummings and Watson

QUADRANGLES: Jersey Mills and Waterville

LOCATION: On side roads off Bull Run Road in Tiadaghton State Forest, on the west rim of Pine Creek Gorge; all within 3 miles south of Waterville.

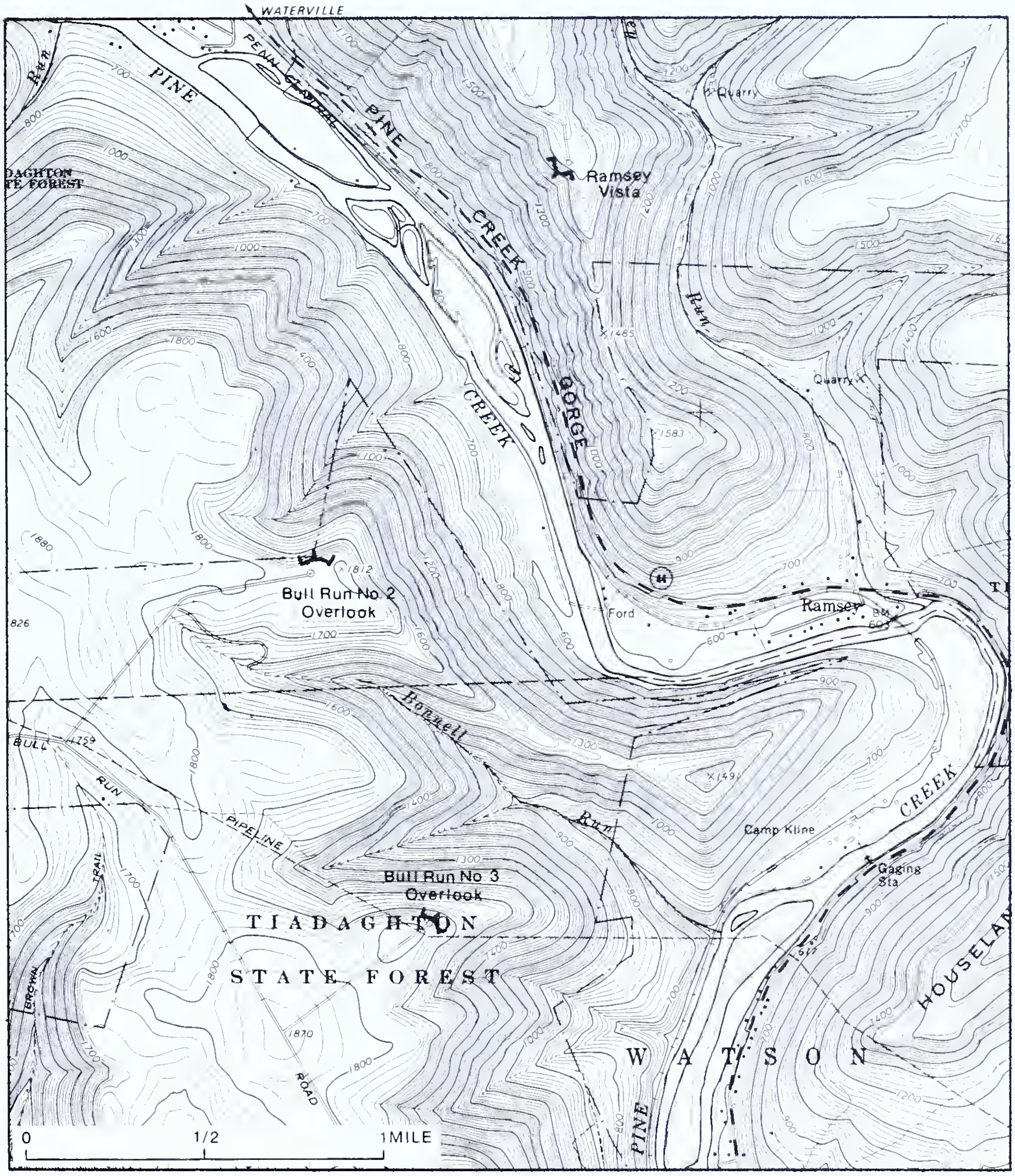
REMARKS: Bull Run Overlooks No. 1 (Cummings Township, Jersey Mills quadrangle), No. 2 (Cummings Township, Waterville quadrangle), and No. 3 (Watson Township, Waterville quadrangle), and **Ramsey Vista** (399) (Cummings Township, Waterville quadrangle), combine to provide the best, most spectacular views of High



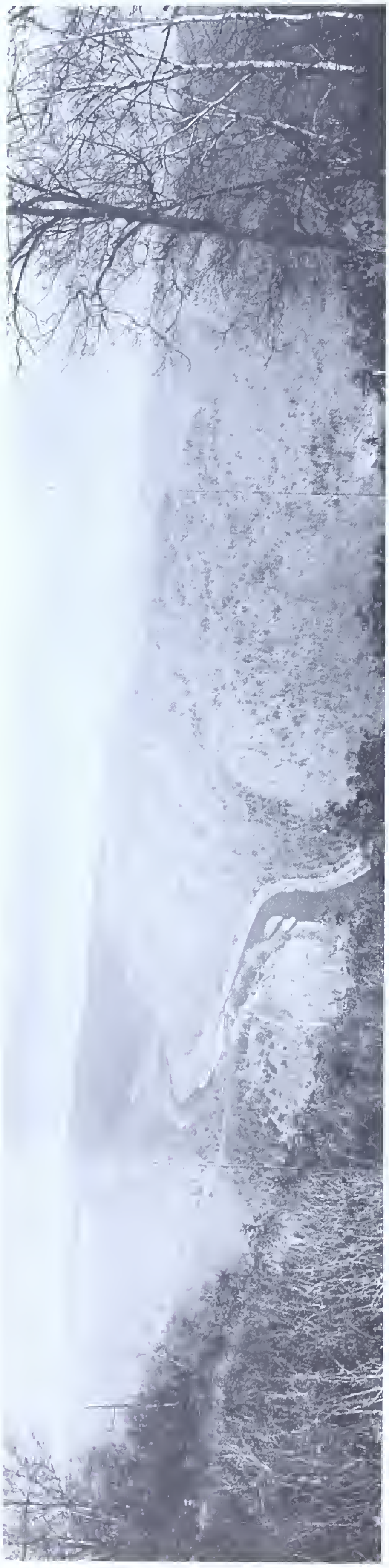
## APPALACHIAN PLATEAUS PROVINCE

## ALLEGHENY HIGH PLATEAUS SECTION

Plateau scenery in Pennsylvania; breathtaking panoramas change with the seasons, each more beautiful than the other.



## 398. BULL RUN OVERLOOKS *(continued)*



APPALACHIAN PLATEAUS PROVINCE

ALLEGHENY HIGH PLATEAUS SECTION

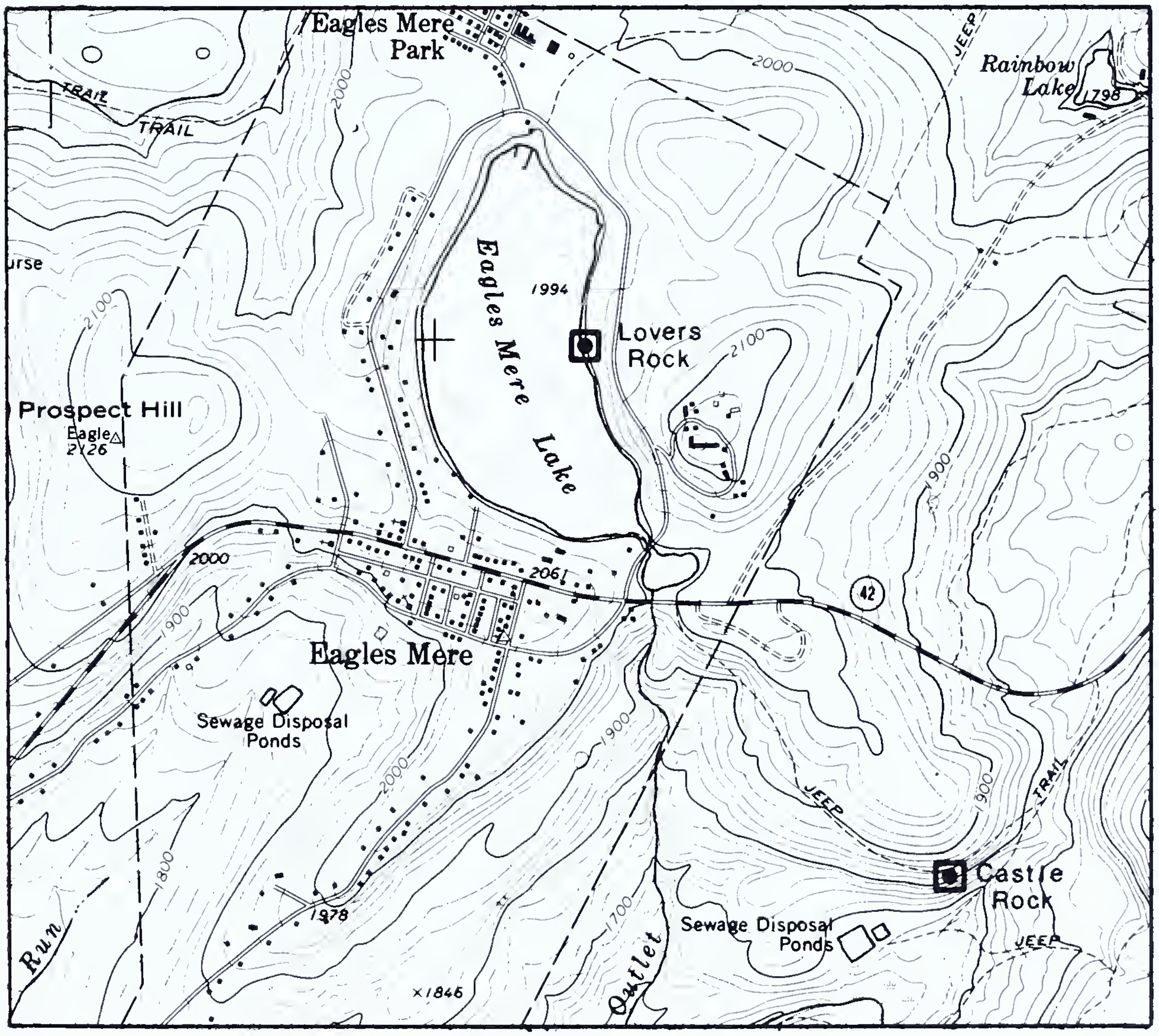
# 400. CASTLE ROCK

COUNTY: Sullivan TOWNSHIP: Shrewsbury

QUADRANGLE: Eagles Mere

LOCATION: About 1 mile southeast of the borough of Eagles Mere; 0.4 mile south of Pa. Route 42, along the Blue Arrow Path.

REMARKS: Several old and well-marked paths (trails) surround Eagles Mere; numerous geologic features may be found along these paths but none are as spec-



## 400. CASTLE ROCK *(continued)*

LOVERS ROCK

tacular as Castle Rock. A magnificent spire of flat-lying layers of tan-colored sandstone and small-pebble conglomerate (Huntley Mountain Formation, Mississippian and Devonian age) rises about 40 feet in the air like a castle tower.

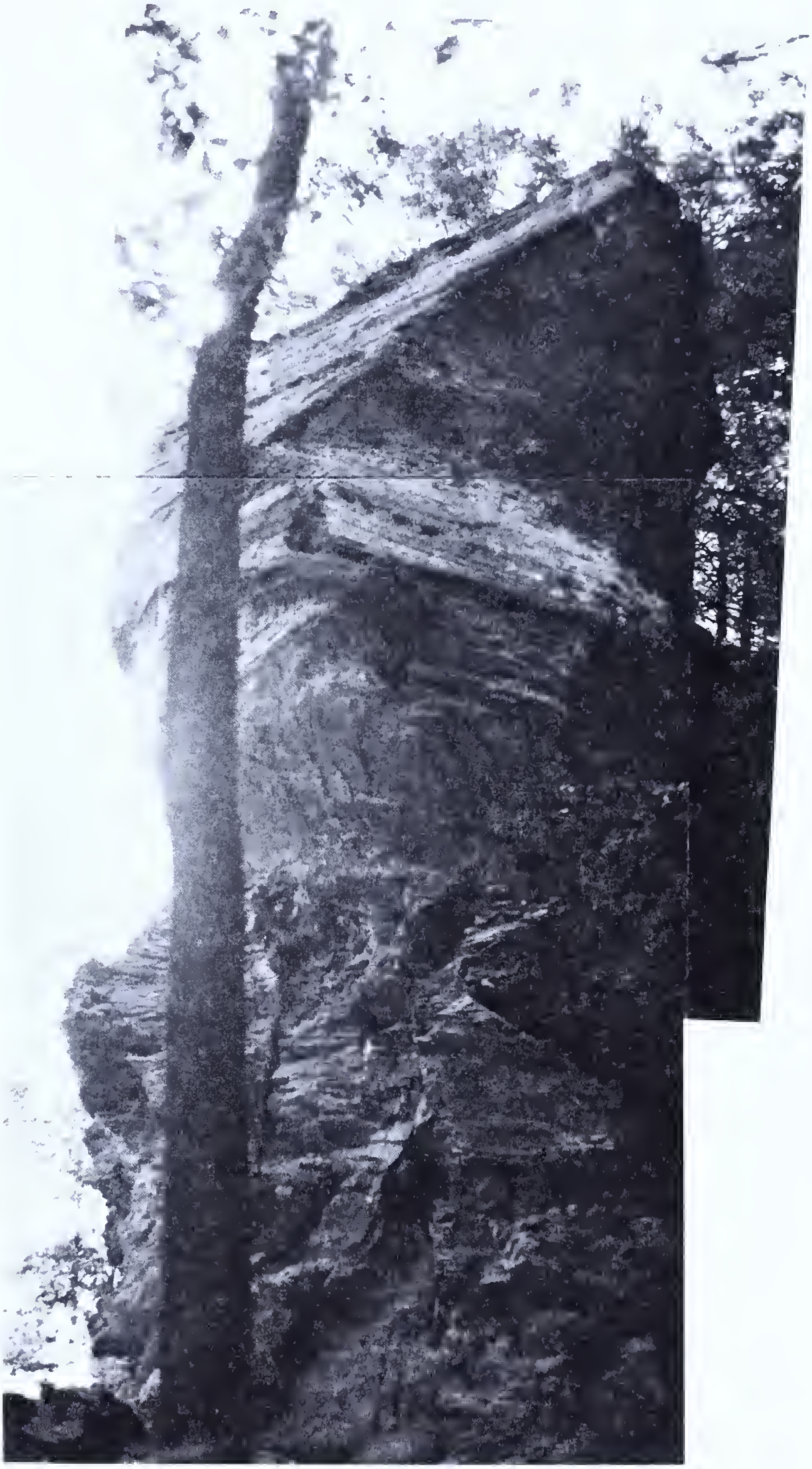
**Lovers Rock** (401), on the east shore of Eagles Mere Lake, is one of many outcrops of sandstone (Burgoon Sandstone, Mississippian age) along the shore; excellent examples of crossbedding may be seen here. Iron-rich minerals in the rock are easily weathered, giving the rock a "rust" or orange-red color.

REFERENCES: Fiocchi, Lou (1984), personal communication, Innkeeper, Eagles Mere Inn, Eagles Mere, Pa.

McFarland, J. H., and McFarland, R. B. (1944), *Eagles Mere and the Sullivan Highlands,* Harrisburg, Pa., J. Horace McFarland Company, 164 p.

APPALACHIAN PLATEAUS PROVINCE

ALLEGHENY HIGH PLATEAUS SECTION



CASTLE ROCK

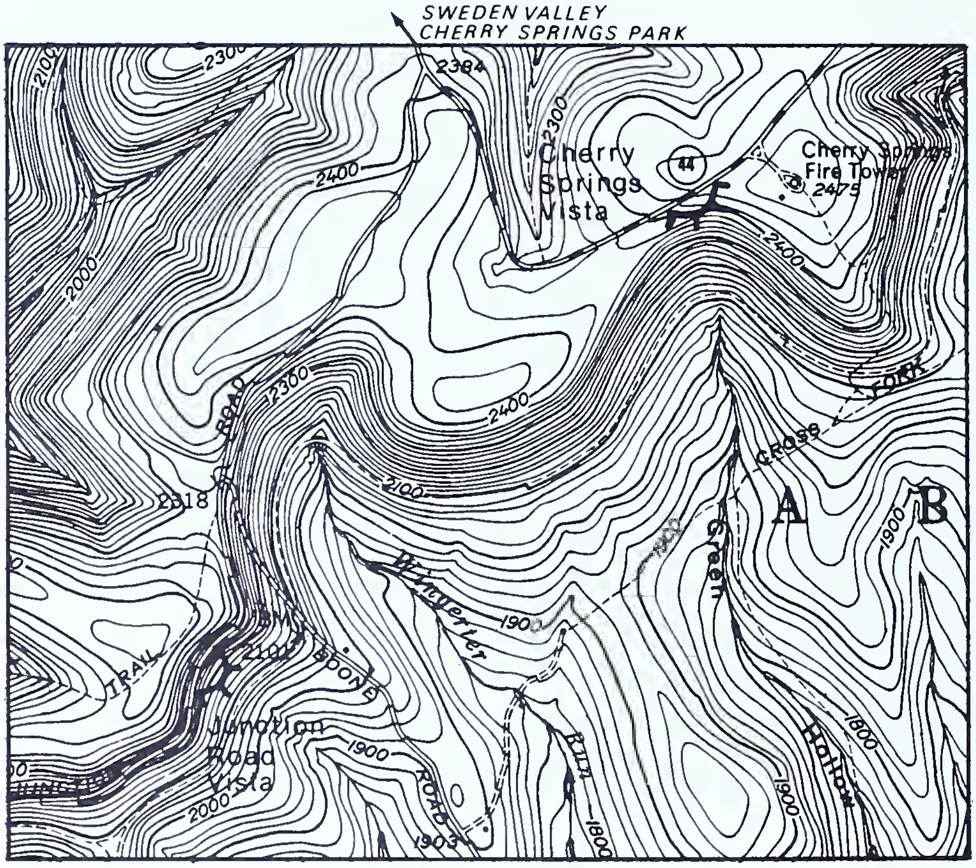
## 402. CHERRY SPRINGS VISTA

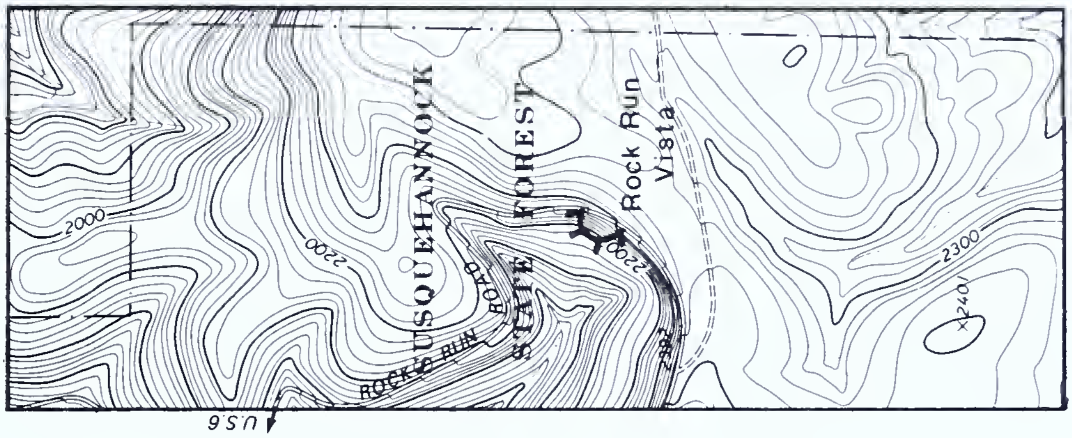
COUNTY: Potter TOWNSHIP: Abbott

QUADRANGLE: Cherry Springs

LOCATION: Along Pa. Route 44 (Coudersport-Jersey Shore Turnpike), about 1 mile southeast of Cherry Springs Park and 10 miles southeast of the village of Sweden Valley.

REMARKS: A scenic view of small tributary streams and gorges in the higher elevations of the plateau in north-central Pennsylvania; the High Plateau is very dissected here and little land surface remains on the flat tops. Similar nearby vistas are **Junction Road Vista** (403), **Rock Run Vista** (404) (Ulysses Township, West Pike quadrangle), and **Horton Run Vista** (405) and **Jamison Run Vista** (406) (both in Eulalia Township, Short Run quadrangle).




SUSQUEHANNOCK
STATE FOREST
Rock Run Vista
ROCK RUN ROAD
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2200
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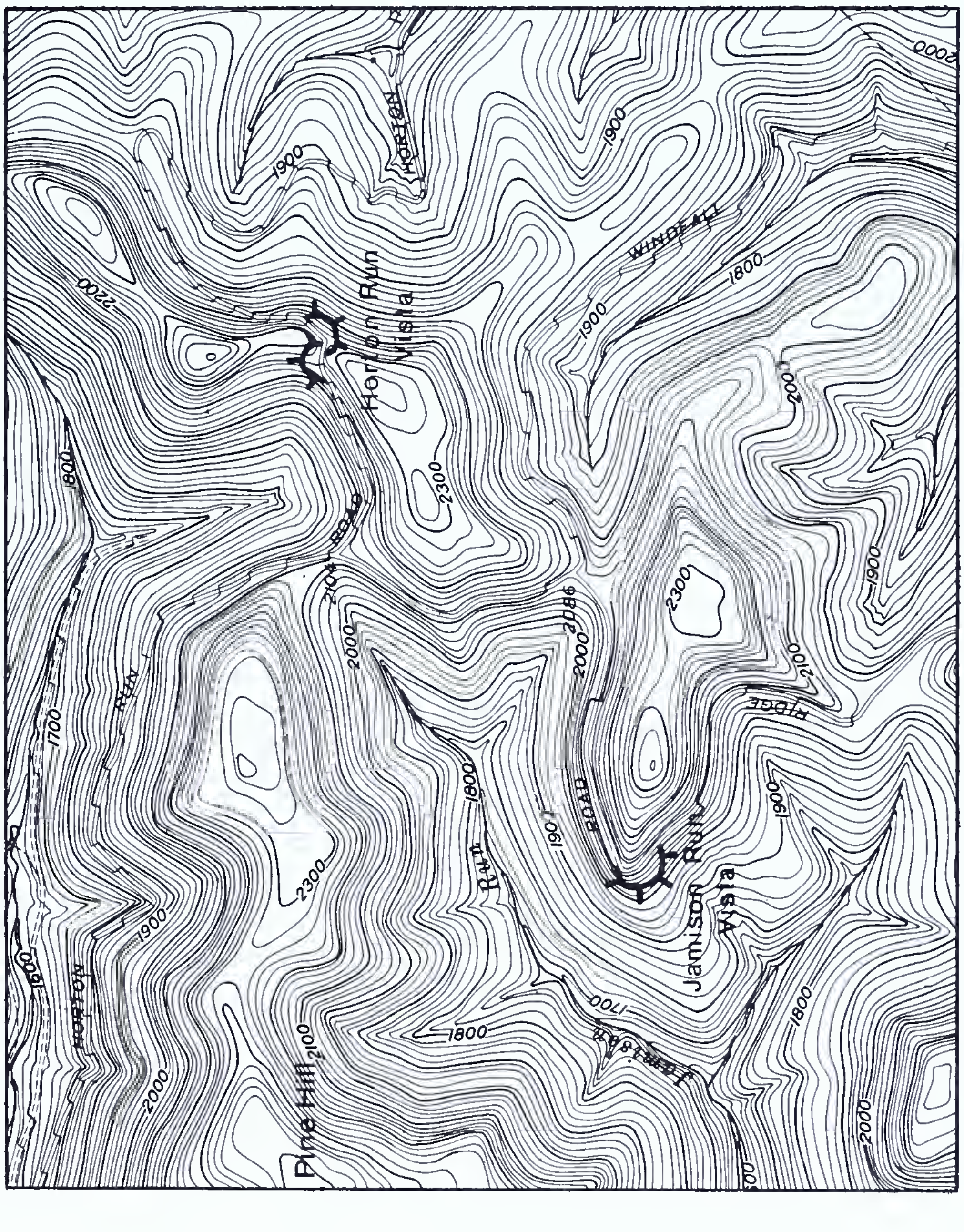
2401
2292
U.S.6


Horton Run Vista
Jamison Run Vista
Pine Hill 2100
HORTON
WINDFALL
RIDGE
ROAD
ROAD
HORTON RUN
RUN
Jamison
2104
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2200
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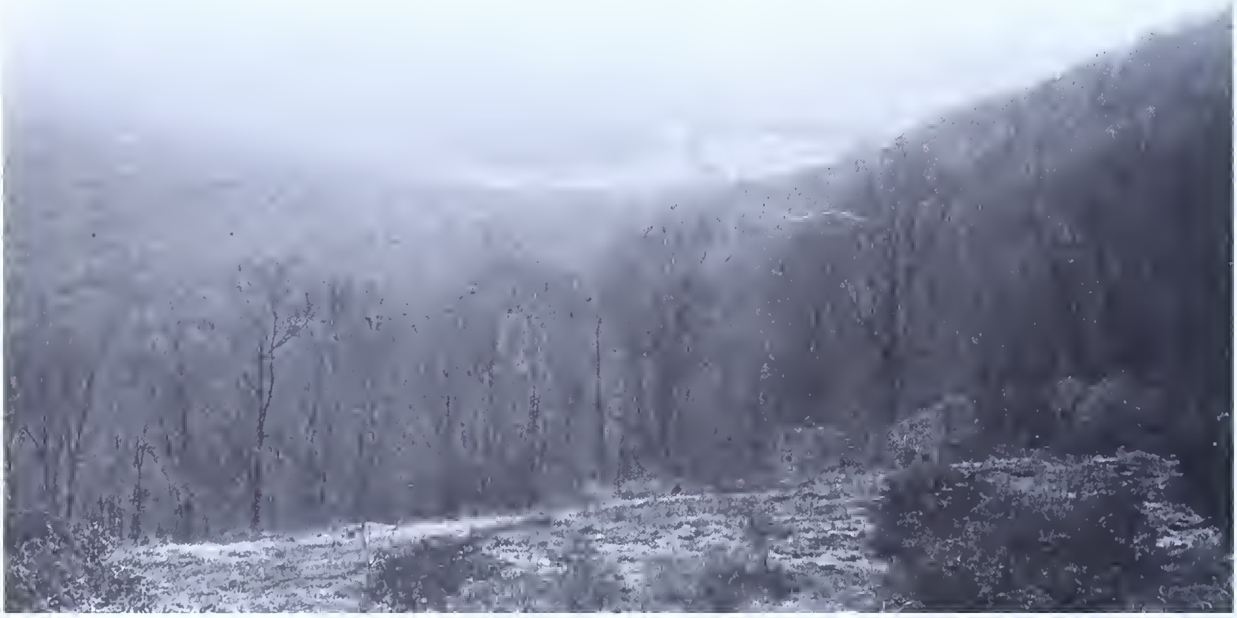
1800
1700
1700
1600

## 402. CHERRY SPRINGS VISTA *(continued)*



CHERRY SPRINGS VISTA

NOTES:

# 407. COLD RUN ROAD FALLS

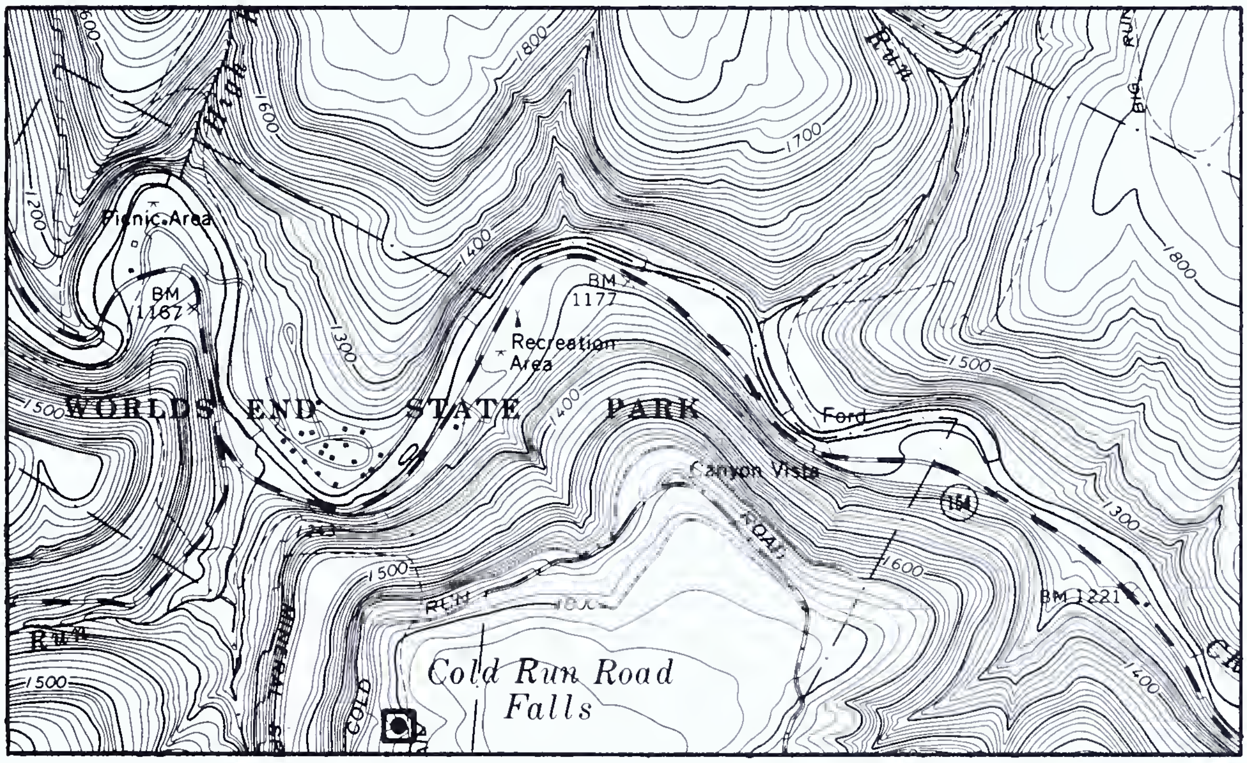
COUNTY: Sullivan TOWNSHIP: Forks

QUADRANGLE: Eagles Mere

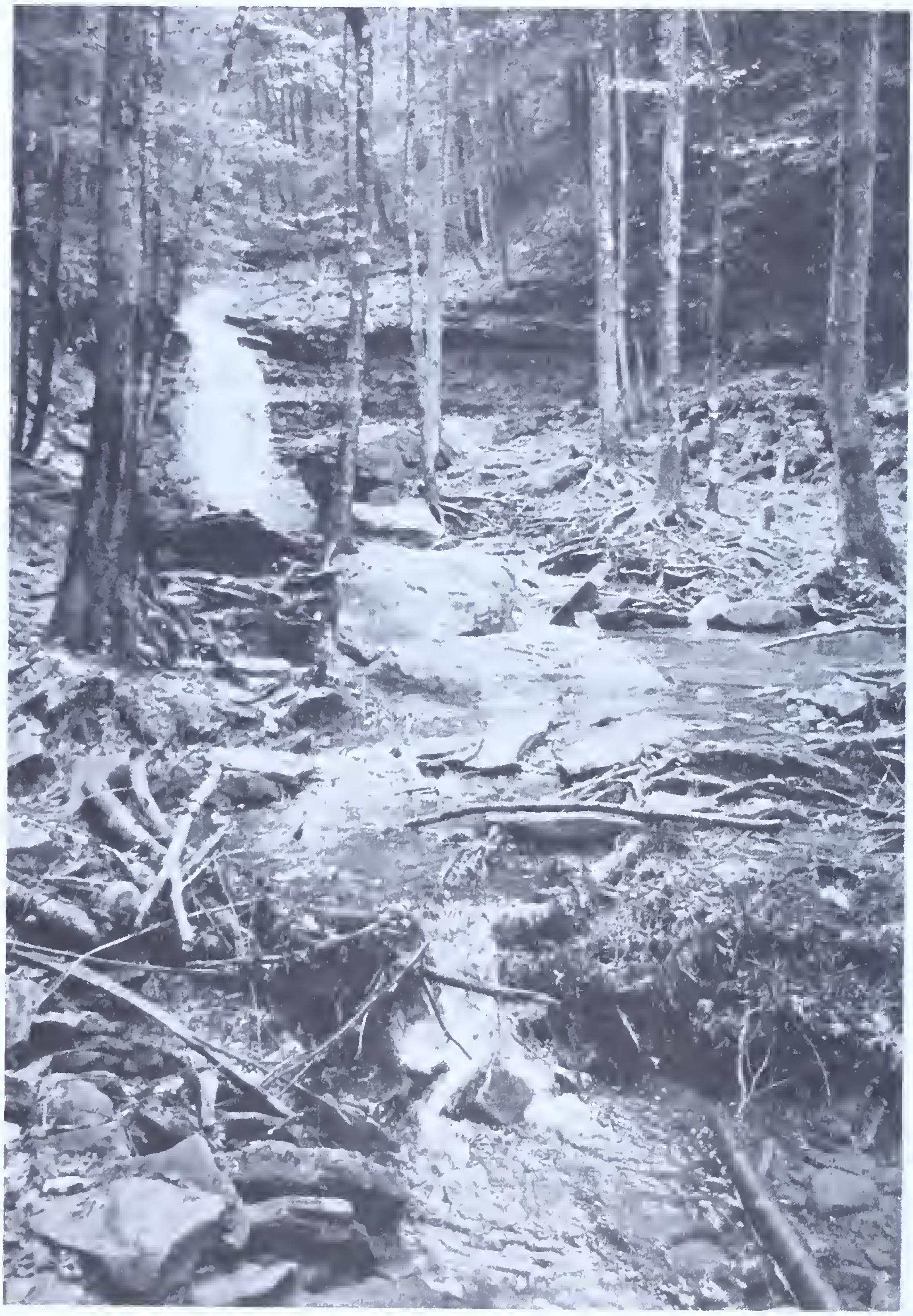
LOCATION: Along Cold Run Road in Worlds End State Park, about 0.6 mile southwest of Canyon Vista.

REMARKS: The small waterfalls occur in a tributary to Loyalsock Creek. Resistant conglomerates of the Pottsville Group (Pennsylvanian age) cap the plateau and the uppermost rim of the falls.

REFERENCE: Royer, D. W. [1980], *Worlds End State Park, Sullivan County—Geologic features of interest,* Pennsylvania Geological Survey, 4th ser., Park Guide 12, pamphlet.



## 407. COLD RUN ROAD FALLS *(continued)*



NOTES:

APPALACHIAN PLATEAUS PROVINCE

ALLEGHENY HIGH PLATEAUS SECTION

# 408. DRY RUN FALLS

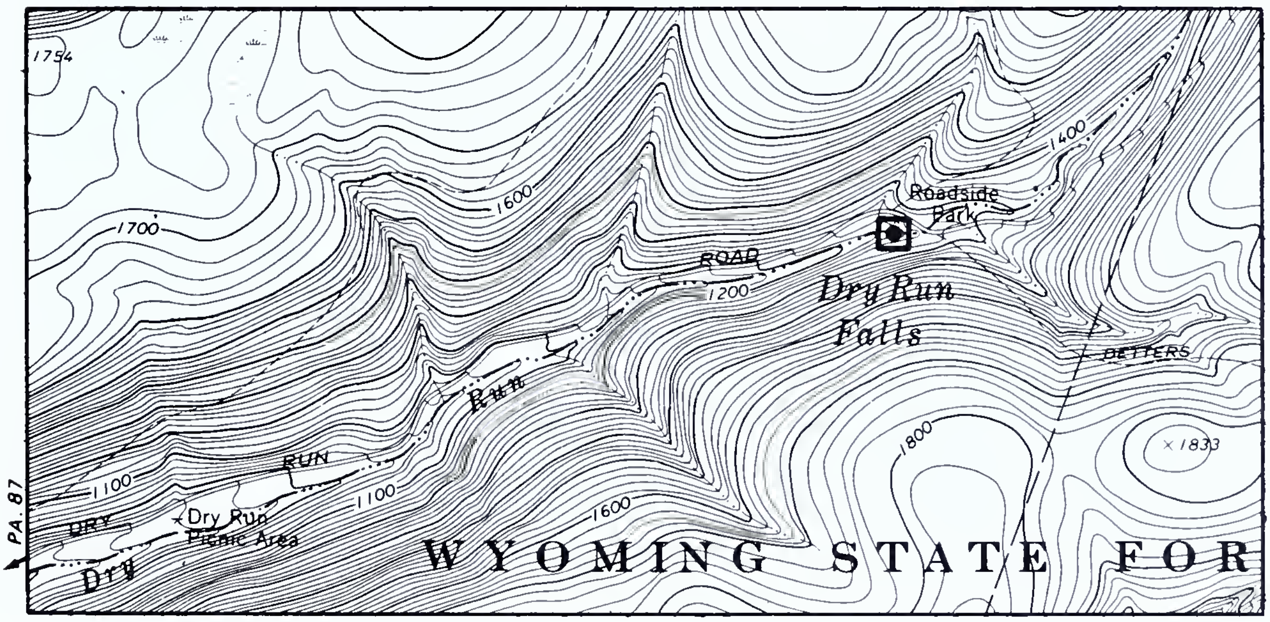
COUNTY: Sullivan TOWNSHIP: Hillsgrove

QUADRANGLE: Hillsgrove

LOCATION: Approximately 2 miles from the intersection of Pa. Route 87 and Dry Run Road along Dry Run Road; at a roadside park in Wyoming State Forest in Dry Run Gorge (site 52 in EG 7, Part 1).

REMARKS: Waterfalls, remoteness, wild, highly scenic—all are words that characterize this site. Red siltstones, sandstones, and shales of the Huntley Mountain Formation (Mississippian and Devonian age) are present in the gorge.

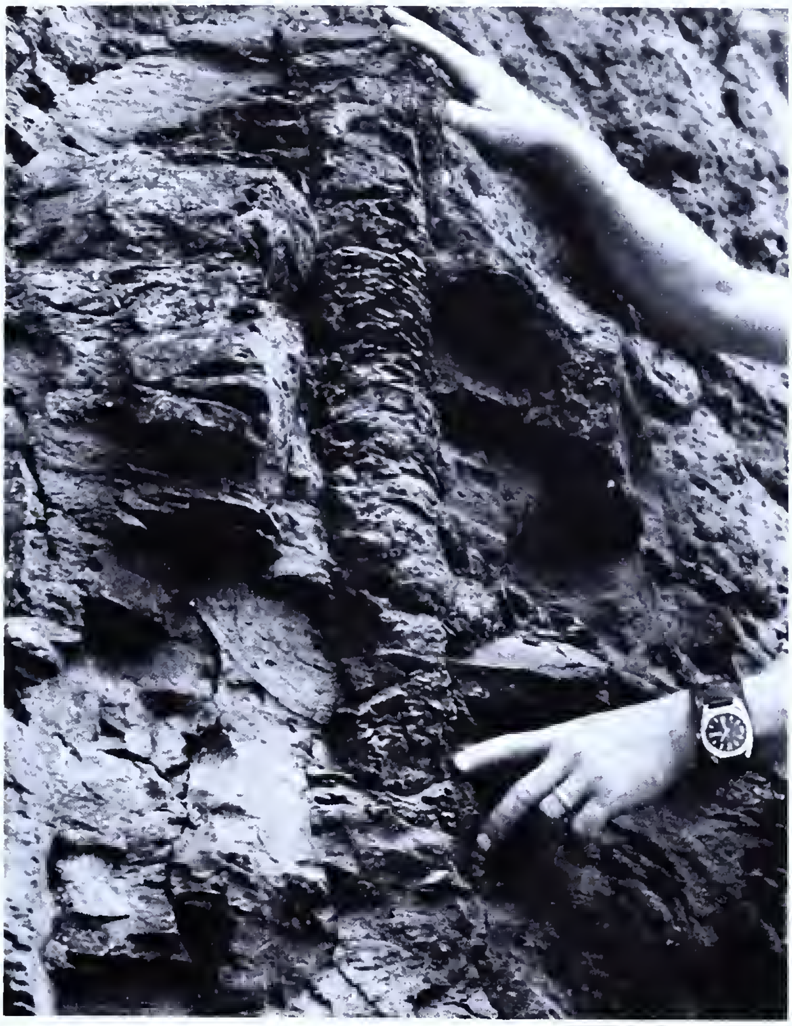
In these red siltstones that are visible along Dry Run Road are fossil fish burrows that were made by an ancestor to the modern lungfish. About 350 million years ago, Sullivan County was part of a series of deltas (similar to the Mississippi River delta). These lungfish of long ago possessed the capability of using oxygen to carry them through periods of drought. At the beginning of a dry period, when the



## 408. DRY RUN FALLS *(continued)*

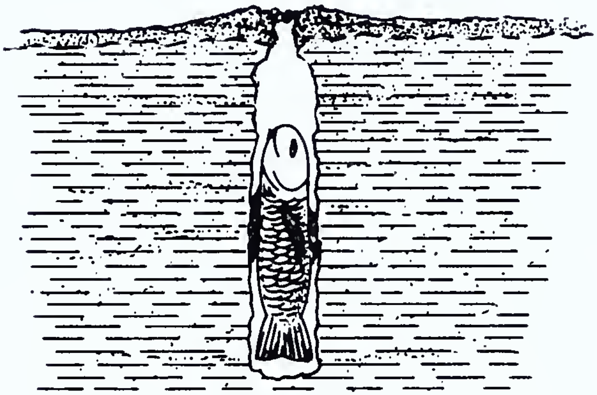
muds of the delta started to dry, these primitive lungfish would burrow tail first in the mud, leaving only a small opening to the surface for air. In this burrow, the fish would go into a deep sleep. When water returned and covered the delta, the fish would awaken and swim away. Many of these burrows were later filled with sands and silts slightly harder than the surrounding muds of the walls of the burrow. Due to weathering, remnants of these original burrows can be observed in the red siltstones of the Huntley Mountain Formation.

REFERENCE: Royer, D. W. [1980], *Worlds End State Park, Sullivan County—Geologic features of interest,* Pennsylvania Geological Survey, 4th ser., Park Guide 12, pamphlet.



(Photograph by T. M. Berg)

Fossil lungfish burrows



Primitive lungfish burrowed in mud
(From Royer, 1980)

# 409. DUTCHMAN FALLS

COUNTY: Sullivan TOWNSHIP: Laporte

QUADRANGLE: Laporte

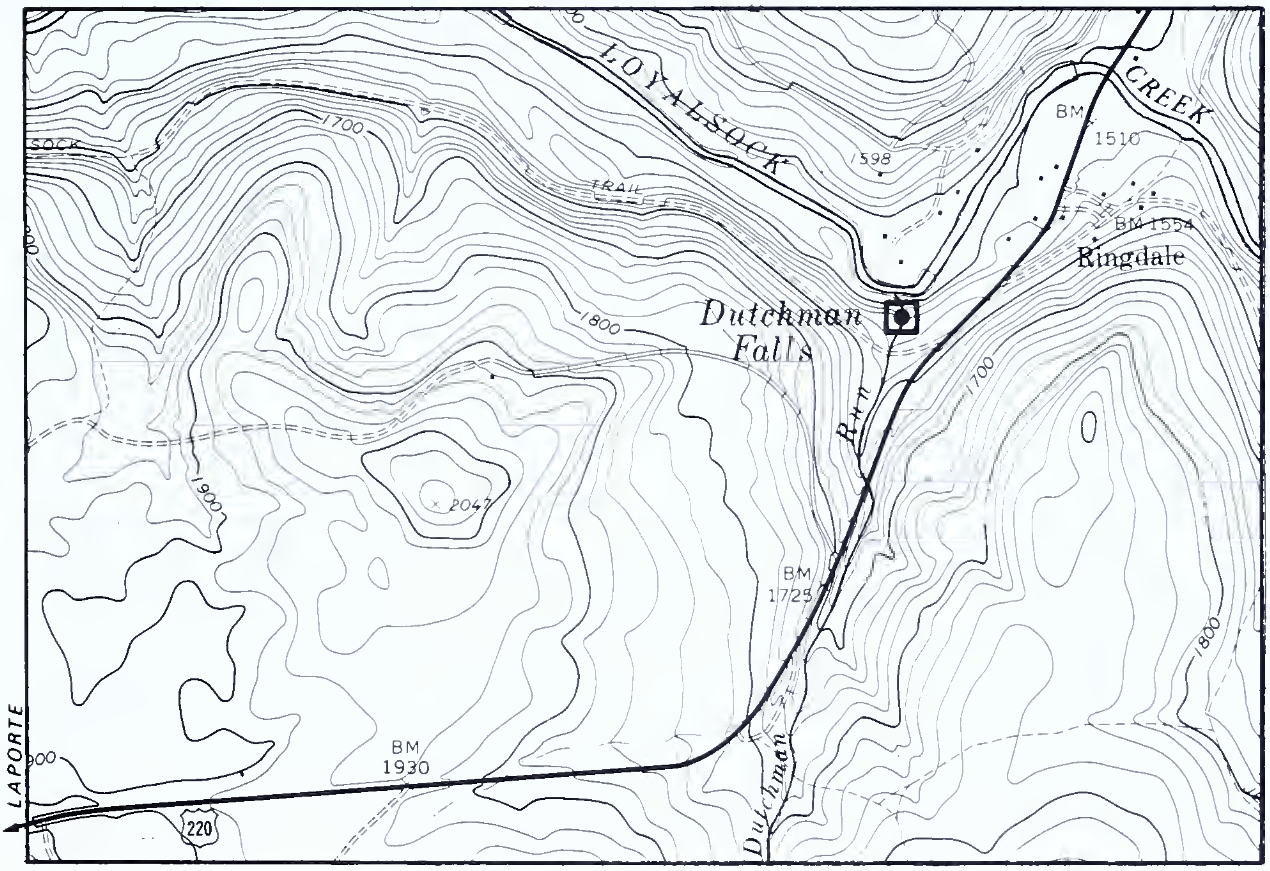
LOCATION: About 3 miles northeast of Laporte, near the village of Ringdale; on Dutchman Run near its mouth; along the Loyalsock Trail near U.S. Route 220, within Wyoming State Forest.

REMARKS: Two cascades of 10 feet and 40 feet occur close together to make one of the most spectacular falls in the region; also known as **Amber Falls**. The water flows over flat-lying beds of sandstone (Huntley Mountain Formation, Mississippian and Devonian age). A beautiful hemlock forest setting with trails and campsites surrounds the falls.

APPALACHIAN PLATEAUS PROVINCE

ALLEGHENY HIGH PLATEAUS SECTION

REFERENCE: Alpine Club (1984), *A guide to the Loyalsock Trail,* P. O. Box 501, Williamsport, Pennsylvania, 20 p.



## 410. FALL BROOK FALLS

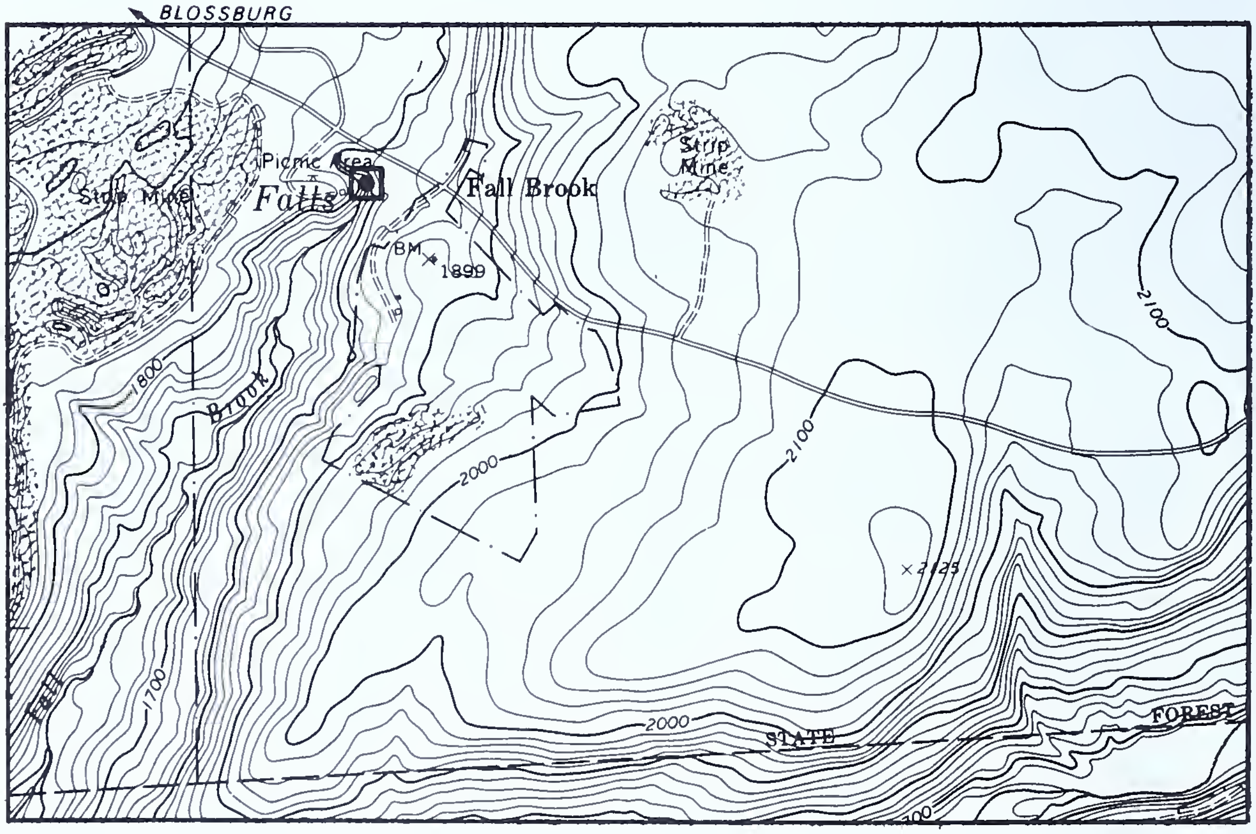
COUNTY: Tioga TOWNSHIP: Ward

QUADRANGLE: Gleason

LOCATION: At the Fall Brook Picnic Area in Tioga State Forest, about 5 miles east of Blossburg.

REMARKS: This series of 10- to 20-foot cascades along Fall Brook forms the largest and most beautiful waterfalls in the county. The cascades fall over massive, flat-lying sandstone (Pottsville Group, Pennsylvanian age) in a hemlock-lined ravine; Fall Brook drops about 40 feet vertically in 600 feet. The site was once a popular picnic area; the only remaining evidence of this is the galvanized pipe railing along the trail overlooking the falls.

Just 5 miles to the east, at the Lambs Hill Picnic Area (**Lambs Hill,** site 78 in EG 7, Part 1), is a



breathtaking overlook at the eastern edge of the High Plateau. The view is to the east across the Glaciated Low Plateau.

NOTES:

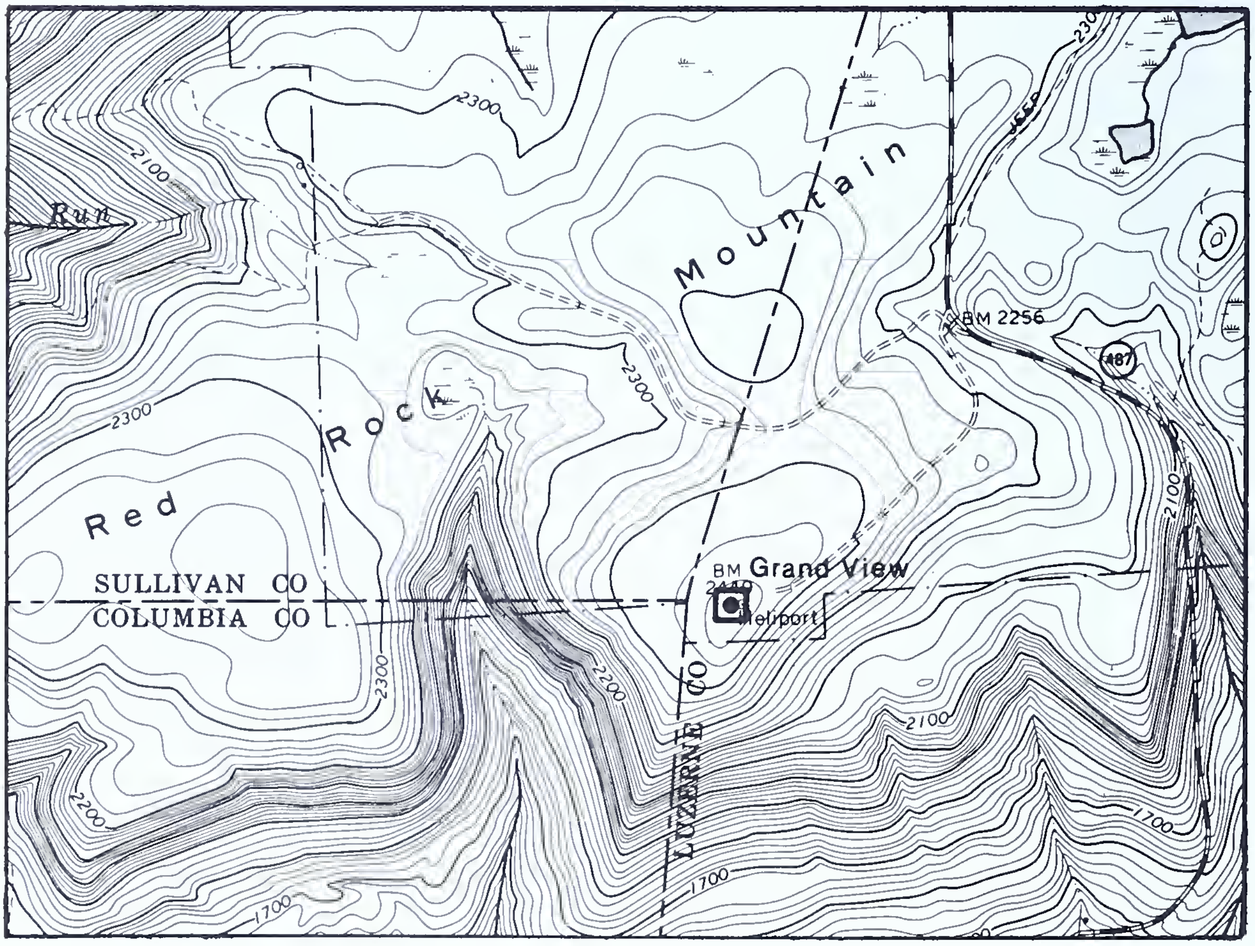
## 411. GRAND VIEW

COUNTY: Luzerne TOWNSHIP: Fairmount

QUADRANGLE: Red Rock

LOCATION: The highest point on Red Rock Mountain; within Ricketts Glen State Park about 400 feet east of the junction of Luzerne, Columbia, and Sullivan Counties.

REMARKS: A spectacular scenic overlook (elevation 2,449 feet) on the rim of the Allegheny Front. The Front and the overlook have been formed by the truncated edges of thick sandstones (Huntley Mountain Formation, Mississippian and Devonian age). Approximately 1,200 feet of relief at Grand View is due to the vast difference in the erosional character of the



red sandstone, siltstone, and shale (Catskill Formation, Devonian age) that underlie the rolling hills to the south and the hard, coarse-grained sandstone and conglomerate (Huntley Mountain Formation, Mississippian and Devonian age, and Pocono Formation, Mississippian age) that form the rim of the Front and the plateau to the north.

REFERENCE: Inners, J. D. [1980], *Ricketts Glen State Park, Luzerne County — The rocks, the glens, and the falls,* Pennsylvania Geological Survey, 4th ser., Park Guide 13, pamphlet.

(Photograph by J. D. Inners)

NOTES:

## 412. HESSELGESSEL STONES

COUNTY: Tioga TOWNSHIP: Shippen

QUADRANGLE: Asaph

LOCATION: Along Hesselgessel Road in the Asaph Wild Area of Tioga State Forest, approximately 4 miles northwest of the village of Asaph.

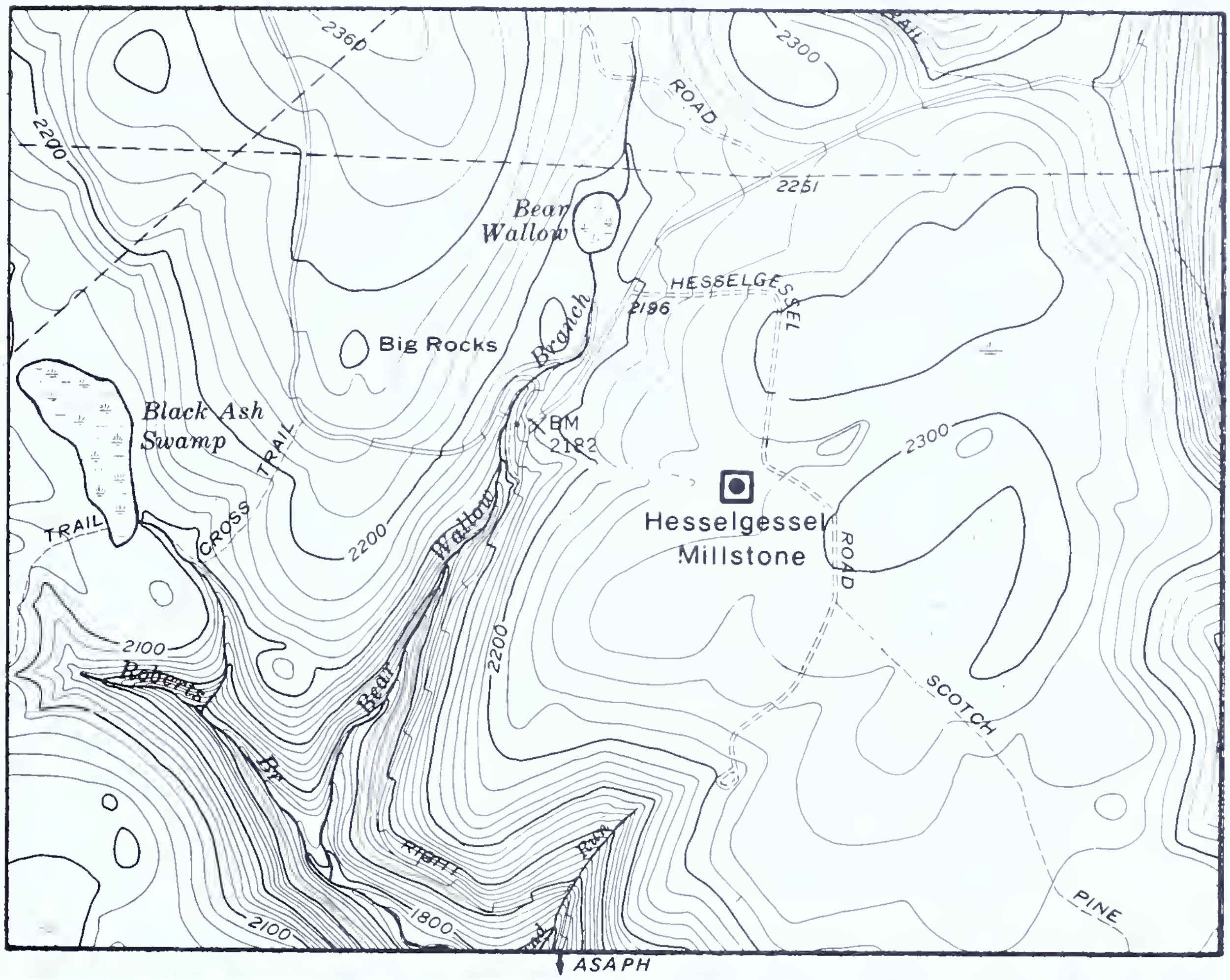
REMARKS: During the 1830's, James Hesselgessel quarried and cut millstones from this site for local grist mills. One nearly complete millstone, cut in 1836, is still visible in the southern part of the quarry. The stones were cut from the Olean Conglomerate (Pottsville Group, Pennsylvanian age).

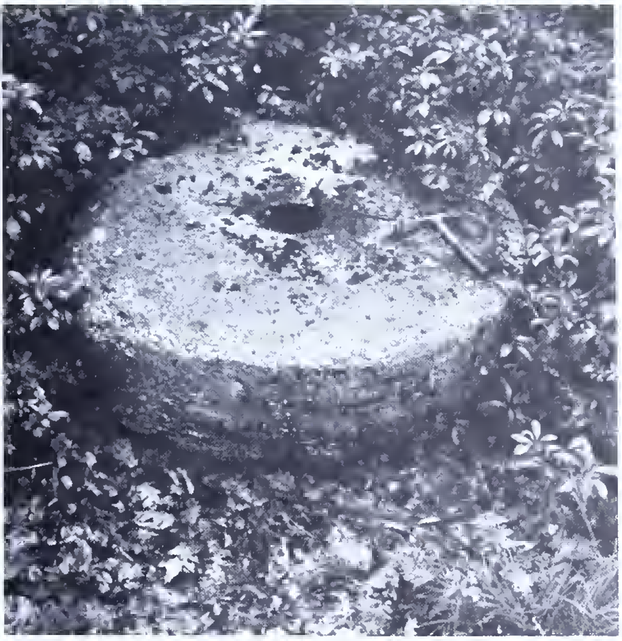
Nearby is **Big Rocks** (413), large outcrops of the same conglomerate.

REFERENCE: Berg, T. M. (1986), *A Sesquicentennial story—Early millstone quarry in Tioga County,* Pennsylvania Geology, v. 17, no. 1, p. 3-6.

(Photograph by T. M. Berg)

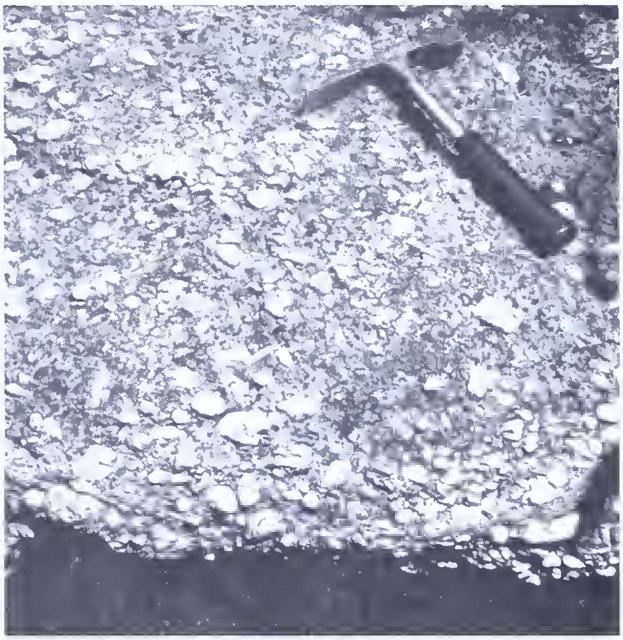
HESSELGESSEL MILLSTONE QUARRY





MILLSTONE IN SOUTHERN PART OF QUARRY

(Photographs by T. M. Berg)



OLEAN CONGLOMERATE IN QUARRY

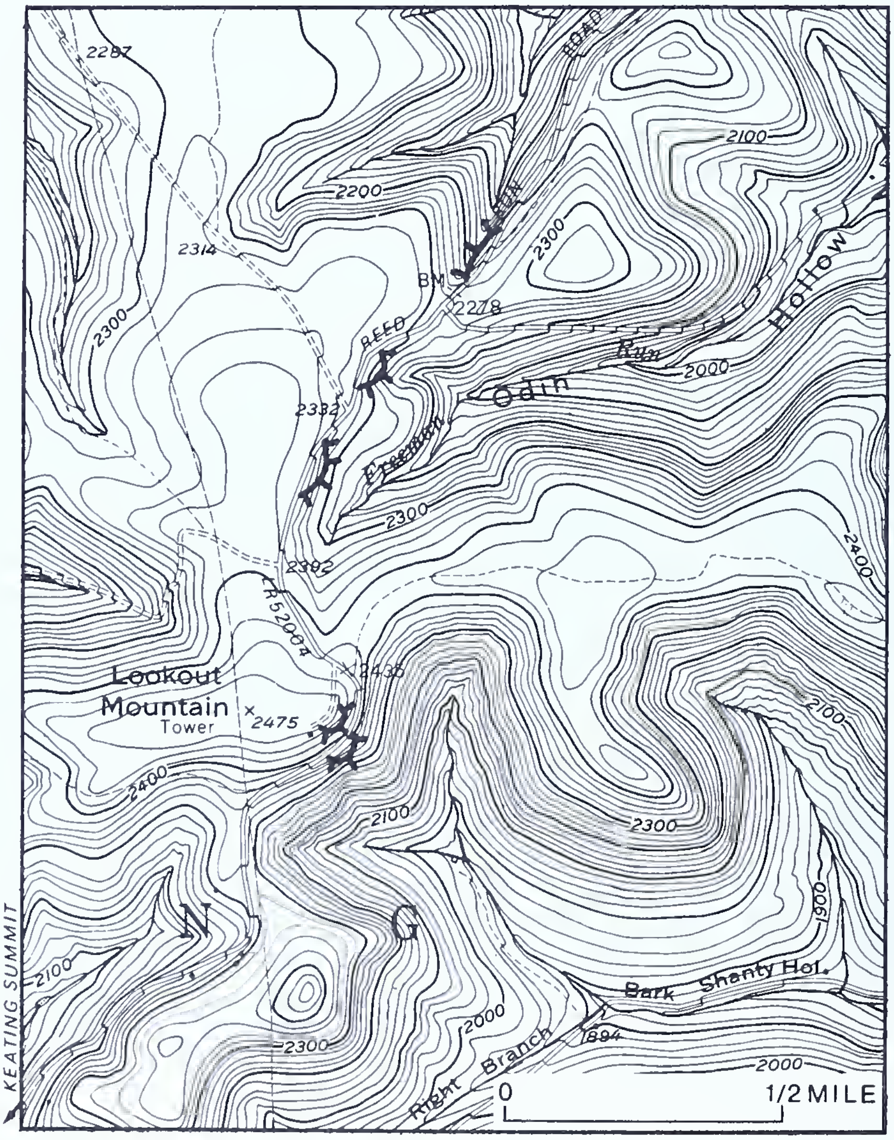
# 414. LOOKOUT MOUNTAIN OVERLOOKS

COUNTY: Potter TOWNSHIP: Keating

QUADRANGLE: Keating Summit

LOCATION: About 2.5 miles northeast of the village of Keating Summit; along Legislative Route 52004 and Reed Run Road; on Susquehanna State Forest Land around Lookout Mountain.

REMARKS: Several overlooks offer some striking scenic views of the High Plateau. Sandstone and siltstone of the Huntley Mountain Formation (Mississippian and Devonian age) underlie the high, flat surfaces here.



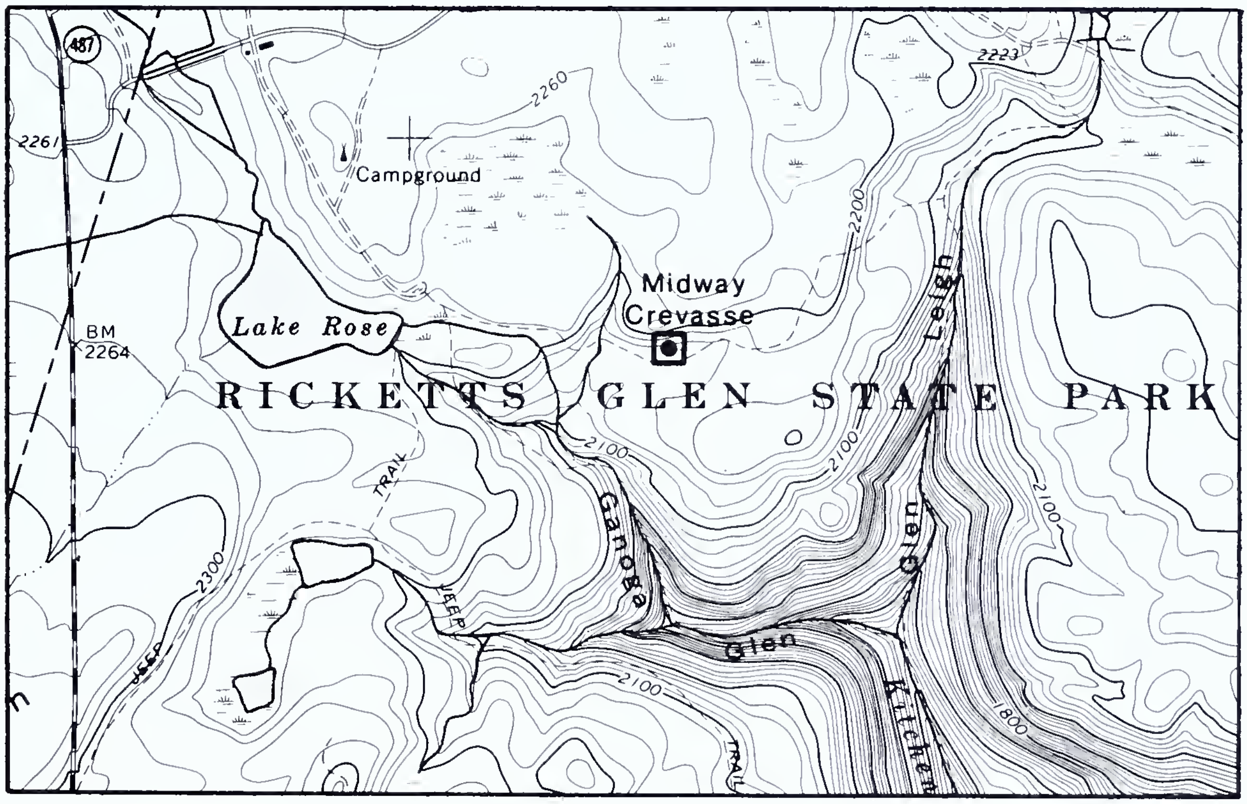
# 415. MIDWAY CREVASSE

COUNTY: Luzerne TOWNSHIP: Fairmount

QUADRANGLE: Red Rock

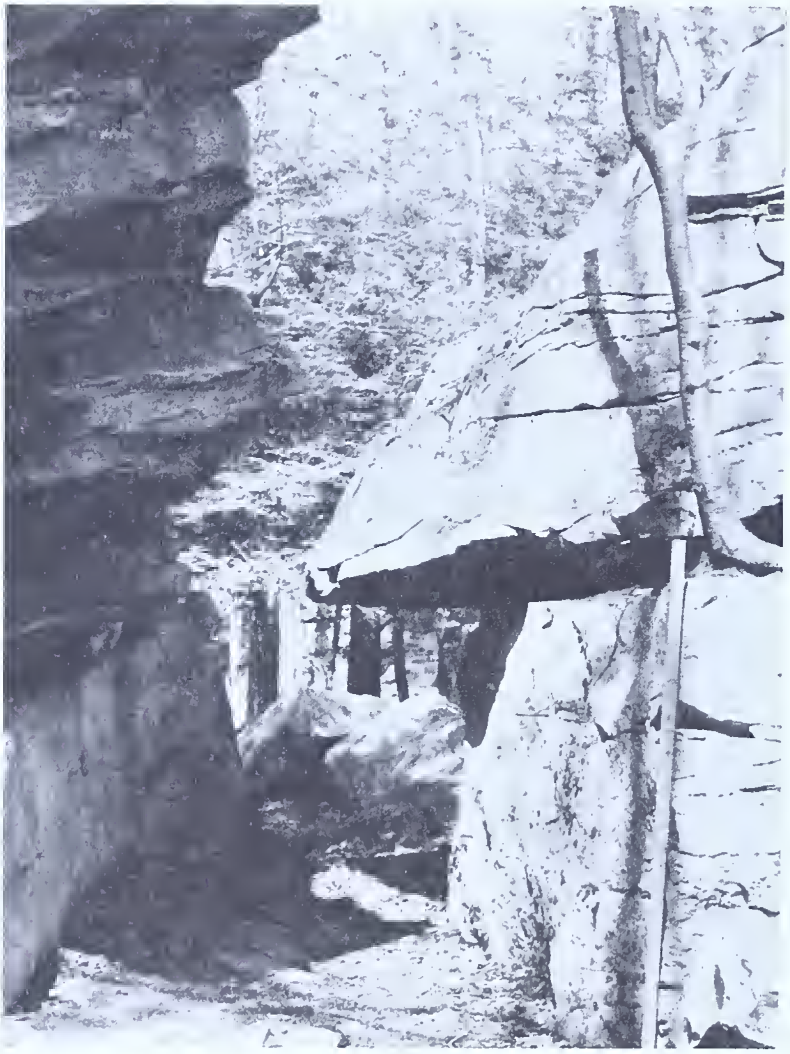
LOCATION: Within Ricketts Glen State Park, approximately 1 mile southeast of the park entrance at Pa. Route 487.

REMARKS: Midway Crevasse is a narrow passageway between large "blocks" of white sandstone and conglomerate (Pocono Formation, Mississippian age) that have been separated along fractures (joints) by frost wedging and gravity creep. The "rock city" of jumbled blocks is about 225 feet long by 35 feet wide. Midway Crevasse (5 feet wide) is the most prominent joint separation in the "city."



## 415. MIDWAY CREVASSE *(continued)*

REFERENCE: Inners, J. D. [1980], *Ricketts Glen State Park, Luzerne County—The rocks, the glens, and the falls,* Pennsylvania Geological Survey, 4th ser., Park Guide 13, pamphlet.



(Photograph by J. D. Inners)

NOTES:

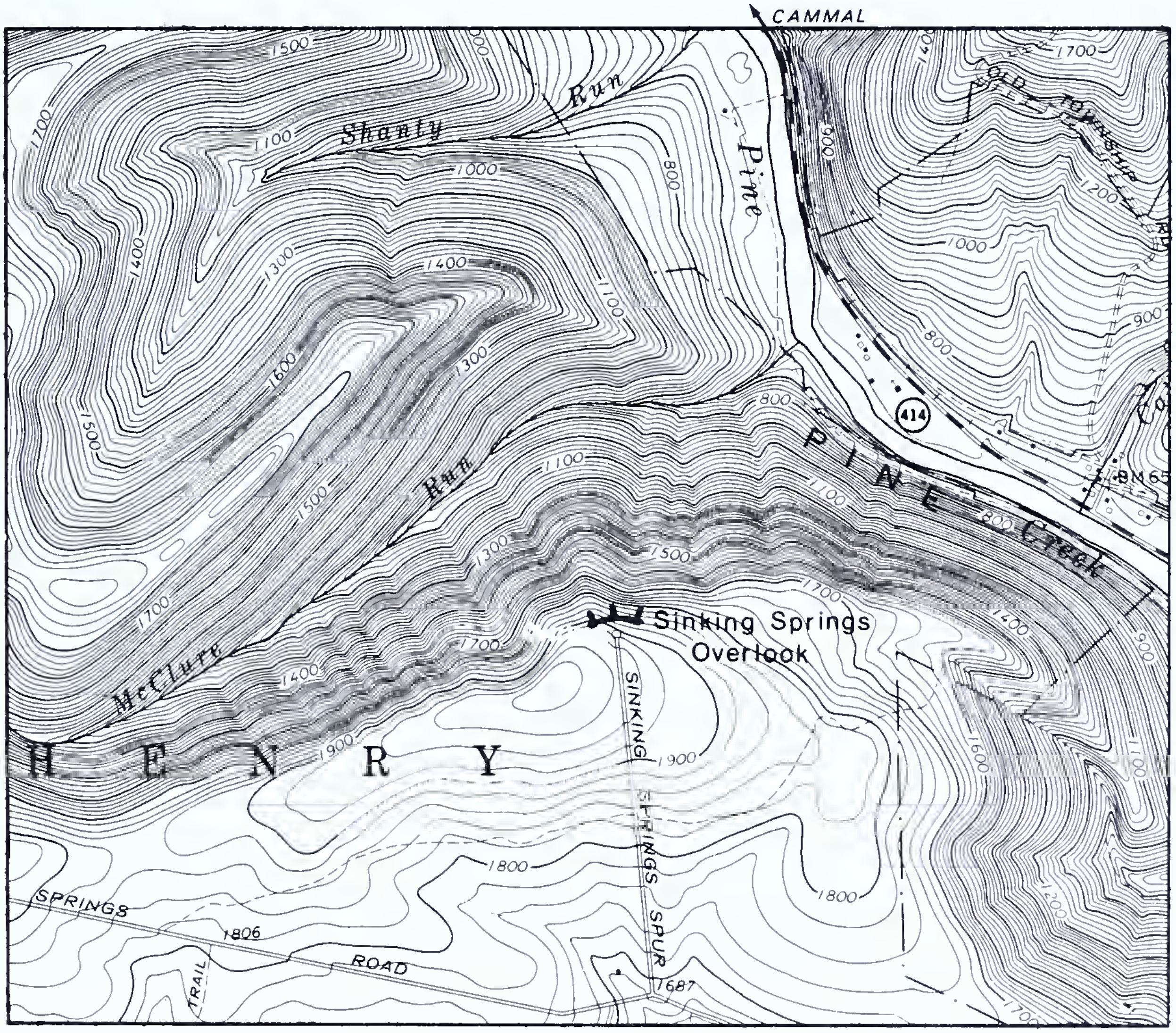
# 416. SINKING SPRINGS OVERLOOK

COUNTY: Lycoming TOWNSHIP: McHenry

QUADRANGLE: Jersey Mills

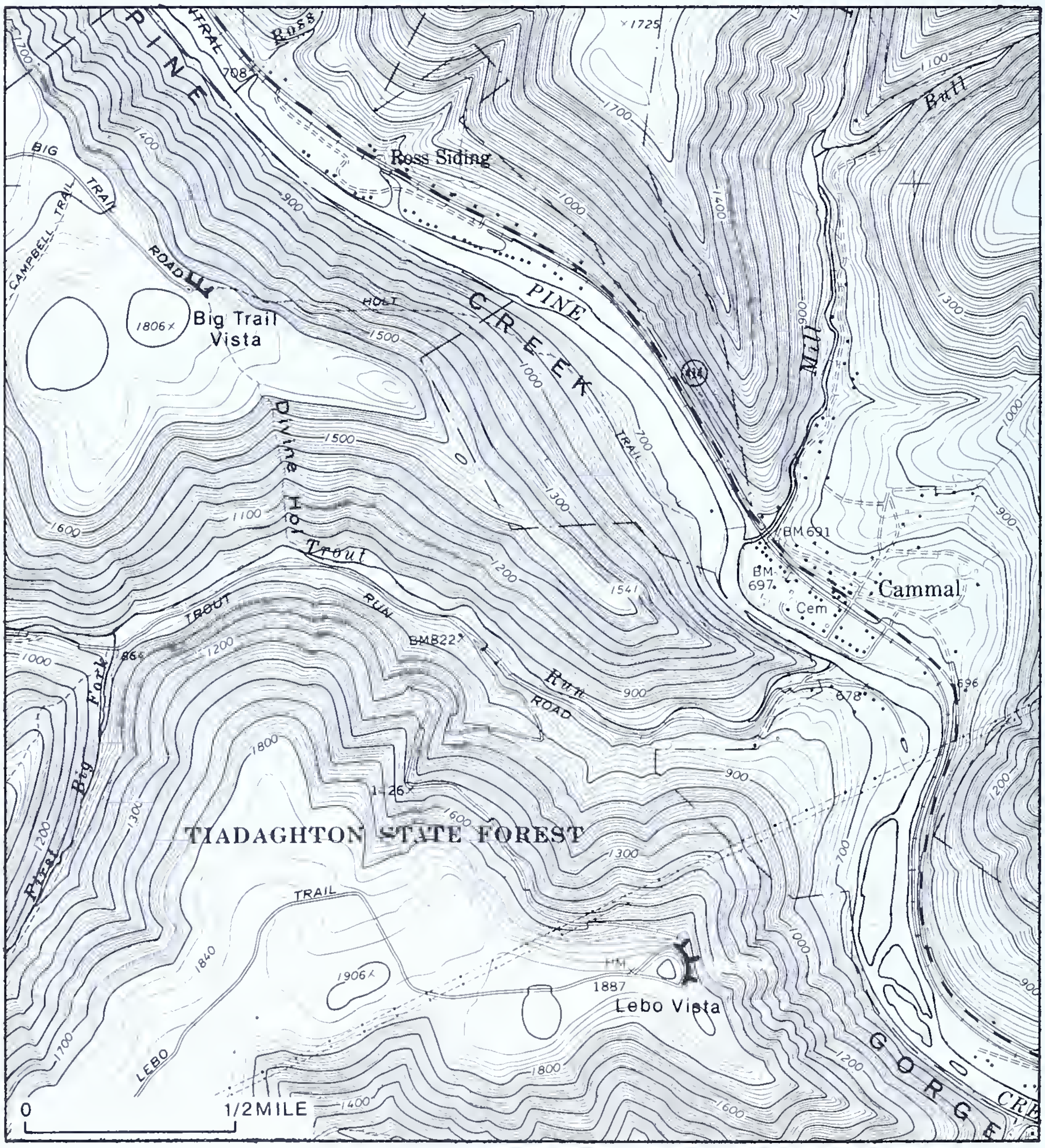
LOCATION: Within the Tiadaghton State Forest on the west rim of Pine Creek Gorge, about 4 miles south of Cammal.

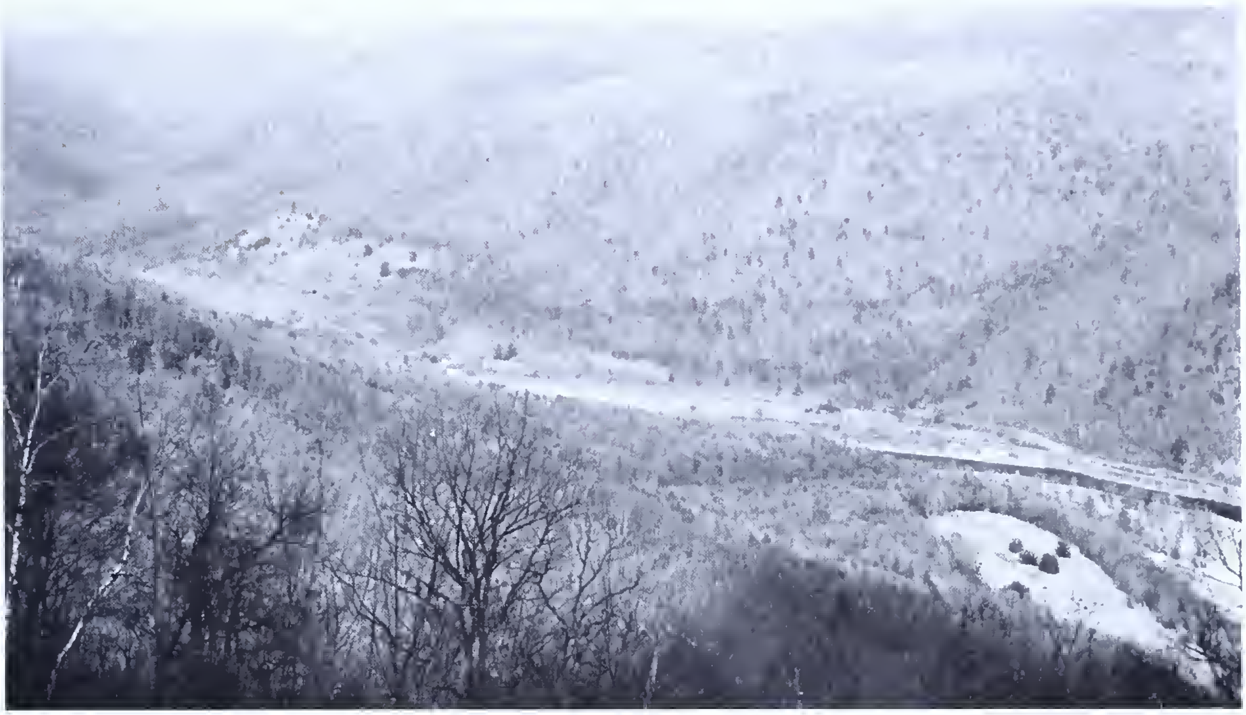
REMARKS: A spectacular view of a short section of Pine Creek Gorge; the scenery is typical of the High Plateau in north-central Pennsylvania, characterized by steep-



## 416. SINKING SPRINGS OVERLOOK *(continued)*

sided, deep gorges and the flat-topped plateau between them. Similar nearby vistas are **Big Trail Vista** (417) and **Lebo Vista** (site 90 in EG 7, Part 1) in McHenry Township, Cammal quadrangle.





SINKING SPRINGS OVERLOOK

NOTES:

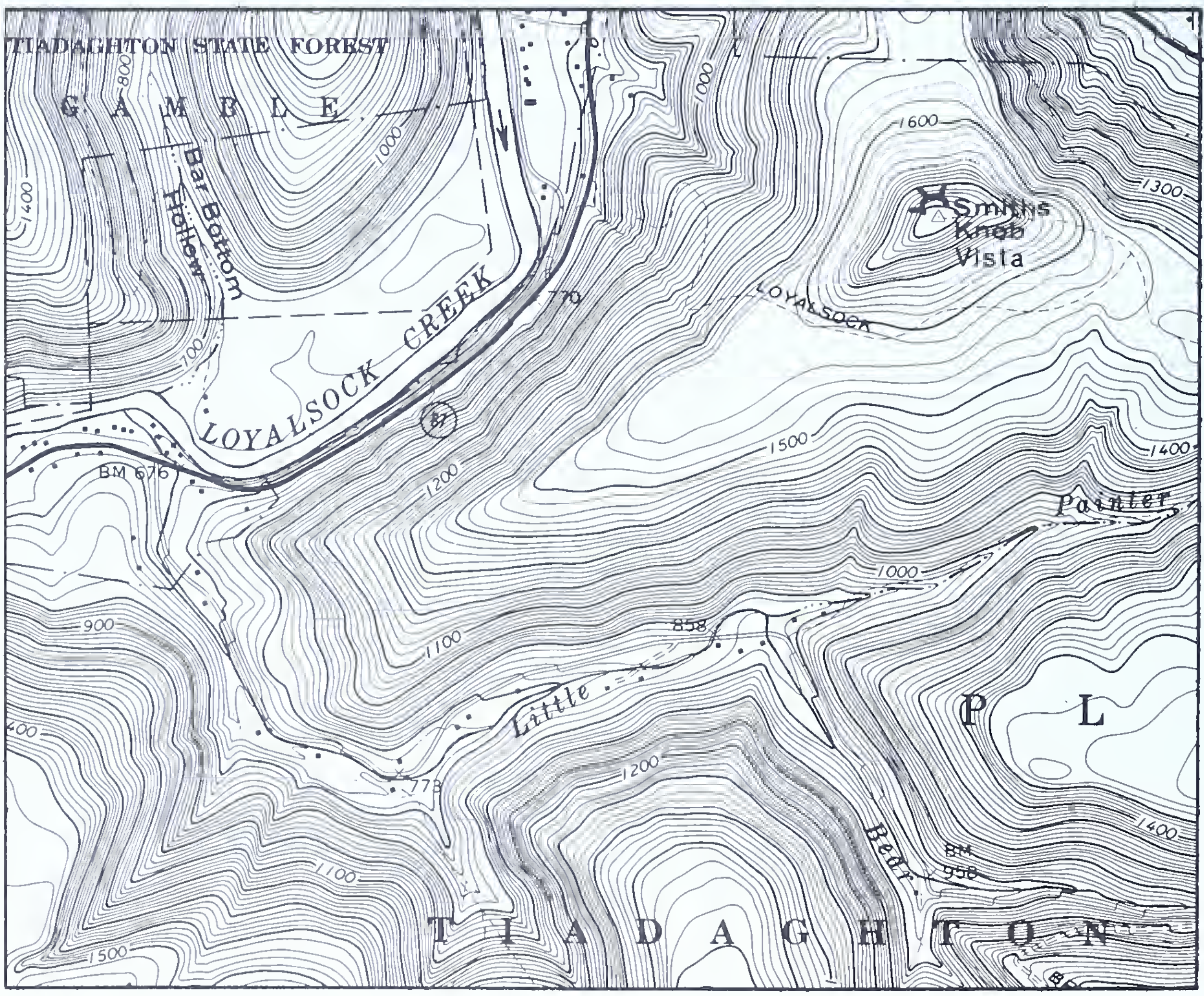
## 418. SMITHS KNOB VISTA

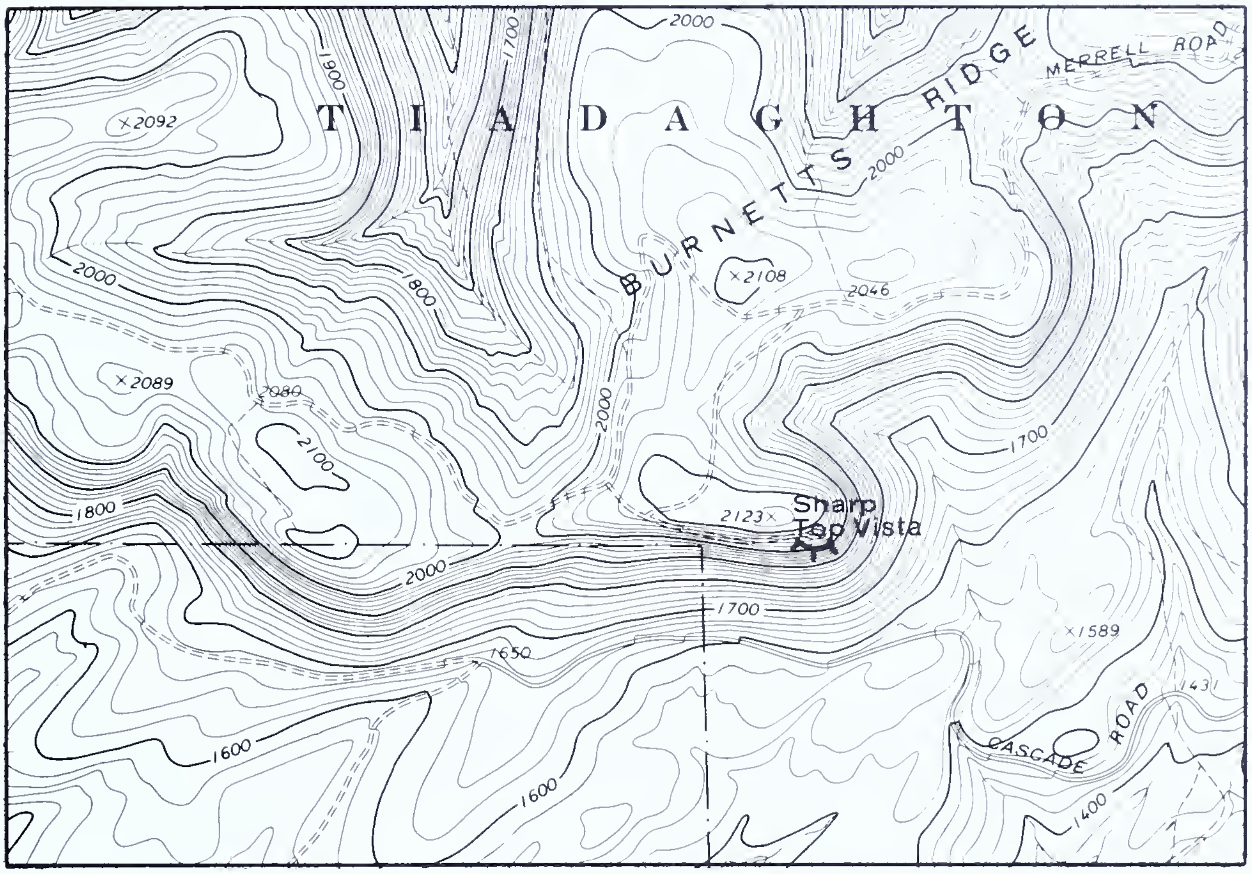
COUNTY: Lycoming TOWNSHIP: Plunketts Creek

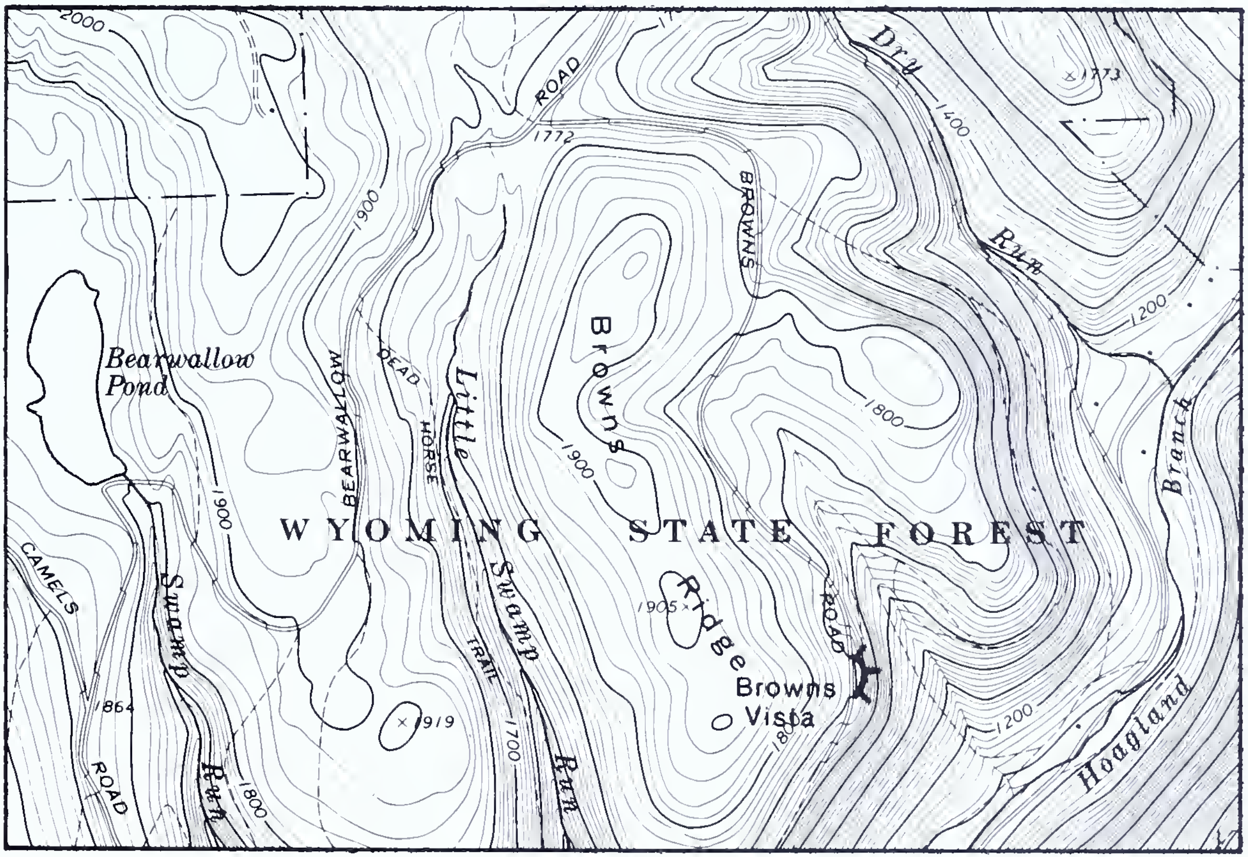
QUADRANGLE: Huntersville

LOCATION: About 2.5 miles southwest of Barbours; on a side trail of the Loyalsock Trail, within Tiadaghton State Forest.

REMARKS: A striking view of the Allegheny High Plateaus in this area and the Loyalsock Creek valley; similar overlooks, and slightly easier to reach, are **Sharp Top Vista** (419) in Cascade Township (Barbours quadrangle) and **Browns Vista** (420) in Sullivan County, Fox Township (Shunk quadrangle).




TIADAGHTON
BURNETTS RIDGE
MERRELL ROAD
×2092
×2108
2046
×2089
2080
2100
2123×
Sharp Top Vista
×1589
1431
CASCADE ROAD
2000
1900
1800
1700
1650
1600
1400


2000
ROAD
1772
×1773
Dry Run
1400
BROWNS
Browns Ridge
1900
1800
1200
Bearwallow Pond
BEARWALLOW
DEAD HORSE TRAIL
Little Swamp Run
WYOMING STATE FOREST
Branch
CAMELS ROAD
Swamp Run
1864
×1919
1700
1905×
ROAD
Browns Vista
Hoagland

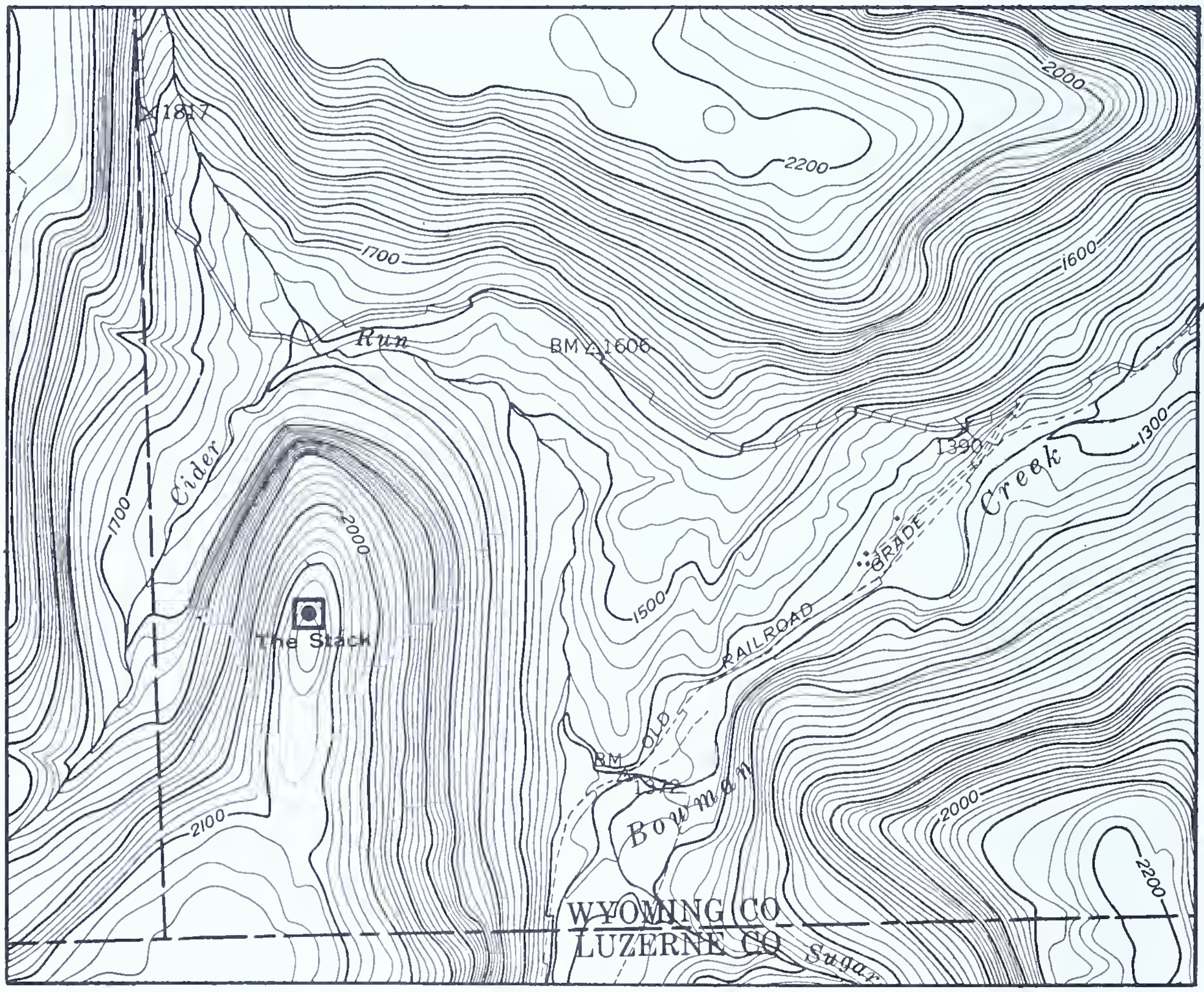
## 421. THE STACK

COUNTY: Wyoming TOWNSHIP: Noxen

QUADRANGLE: Dutch Mountain

LOCATION: Approximately 7.1 miles west of Noxen and Pa. Route 29.

REMARKS: Massive sandstone of the Burgoon Sandstone (Mississippian age) forms the cap of this topographic feature. The high resistance to weathering of this sandstone accounts for its relatively high topographic elevation; erosion explains the shape of the feature that gives it its name.

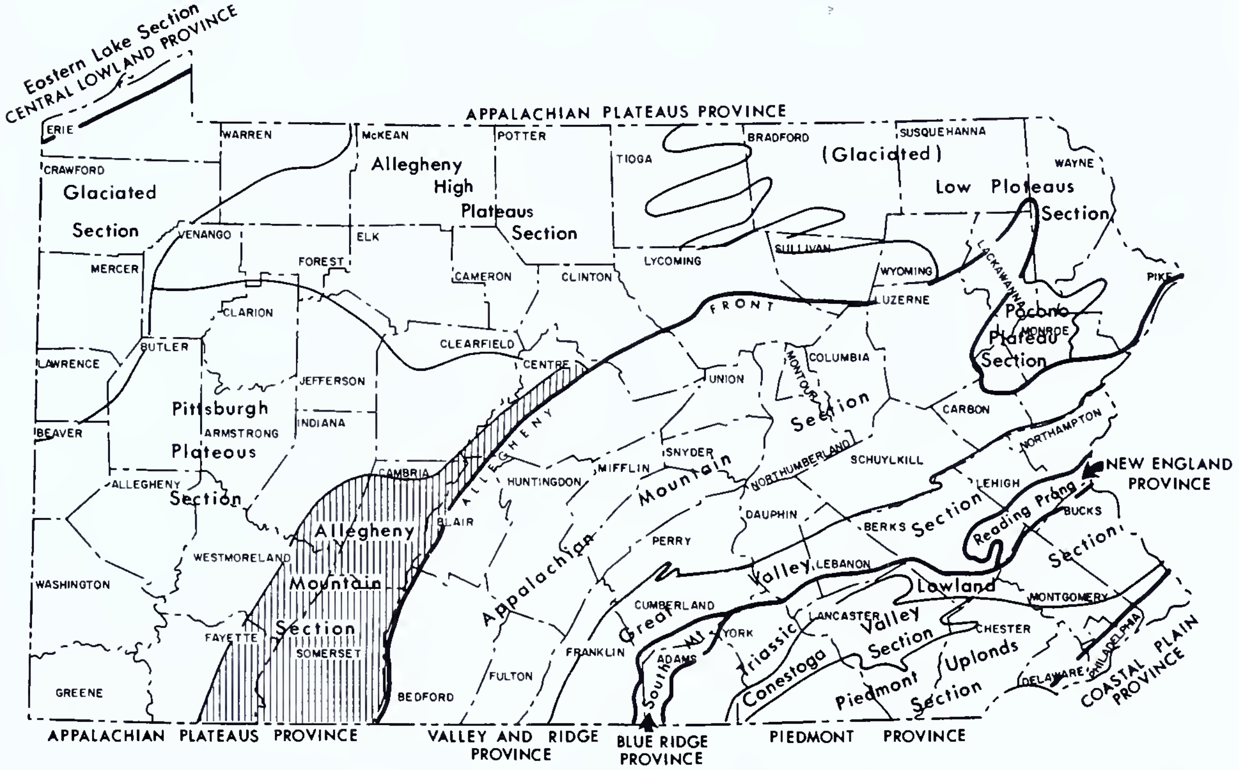


# APPALACHIAN PLATEAUS PROVINCE— ALLEGHENY MOUNTAIN SECTION

## *TOPOGRAPHY*

The Allegheny Mountain section of the Appalachian Plateaus province is bounded on the west by Chestnut Ridge (crest is 2,778 feet above sea level) and Laurel Hill (crest ranges from 2,800 to over 3,000 feet above sea level) and on the east by the Allegheny Front.

The greatest local relief within this section is approximately 1,600 feet at the Conemaugh River gap through Laurel Hill.



## *ROCK COLUMN*

The rock column is composed mostly of shale, siltstone, sandstone, and conglomerate. No carbonates occur in the Devonian rocks, but the Mississippian and Pennsylvanian Systems contain some in minor amounts. The limestones are thin and are interbedded with shales and sandstones. The Pennsylvanian System also includes beds of clay (mudstone) and coal.

Shale is the most common rock type in the section. Sandstones are present throughout the geologic rock column.

A description of the rock units follows:

| SYSTEM | ROCK UNIT | DESCRIPTION |
|---|---|---|
| Pennsylvanian | Monongahela Group | Some limestone; some coal; light-gray sandstone; dark-gray shale; very little of this group is present in this section. |
| | Conemaugh Group<br>Casselman Formation<br>Glenshaw Formation | Some shaly, gray limestone; numerous poor-quality coals; gray shale; coarse-grained sandstone. |
| | Allegheny Group | Several minable coals; major sandstone units; some shale, claystone, and limestone. |
| | Pottsville Group | Light-gray coarse-grained sandstone; small amounts of gray shale, limestone, coal, and underclay. |
| Mississippian | Mauch Chunk Formation | Gray and green sandstones; red shale, siltstone, and claystone. |
| | Loyalhanna Limestone | Sandy, red to gray, crossbedded limestone. |
| | Burgoon Sandstone | Light-gray to greenish-gray sandstone; some shale and siltstone; a few coal beds. |
| Mississippian and Devonian | Rockwell Formation | Gray, fine- to coarse-grained sandstone; siltstone, shale, and, locally, pebbly mudstone. |
| Devonian | Oswayo Formation | Greenish-gray sandstone; minor shale units. |
| | Catskill Formation | Red shale, sandstone, conglomerate, and siltstone. |
| | Foreknobs Formation | Medium- to olive-gray sandstone, siltstone, and shale. |
| | Scherr Formation | Olive- and greenish-gray, fossiliferous siltstone, shale, and sandstone. |

## *ROCK STRUCTURE*

The major structural features of the section are, from west to east, the Chestnut Ridge anticline, the Ligonier syncline, and the Laurel Hill anticline.

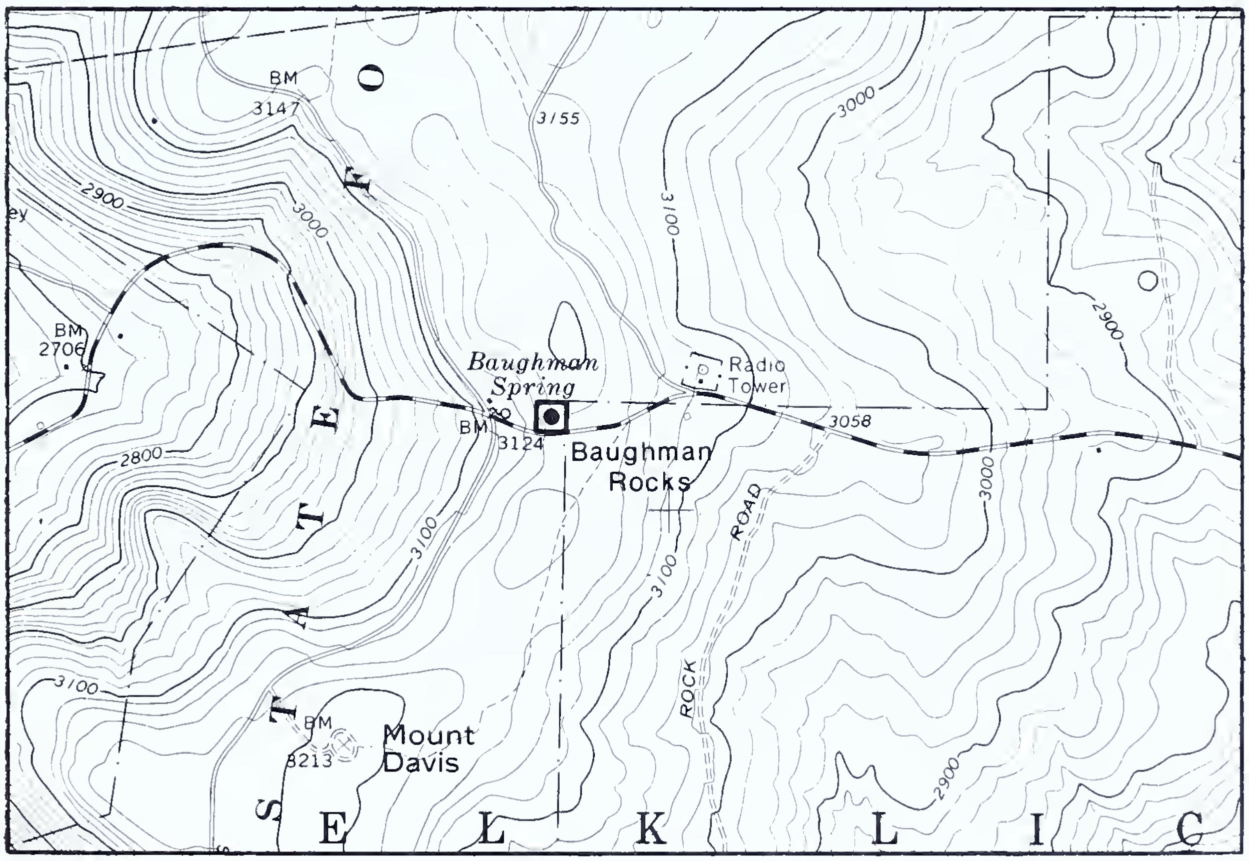
# 422. BAUGHMAN ROCKS

COUNTY: Somerset TOWNSHIP: Elk Lick

QUADRANGLE: Markleton

LOCATION: Within Forbes State Forest, 250 feet north of the road at the main entrance to Mount Davis.

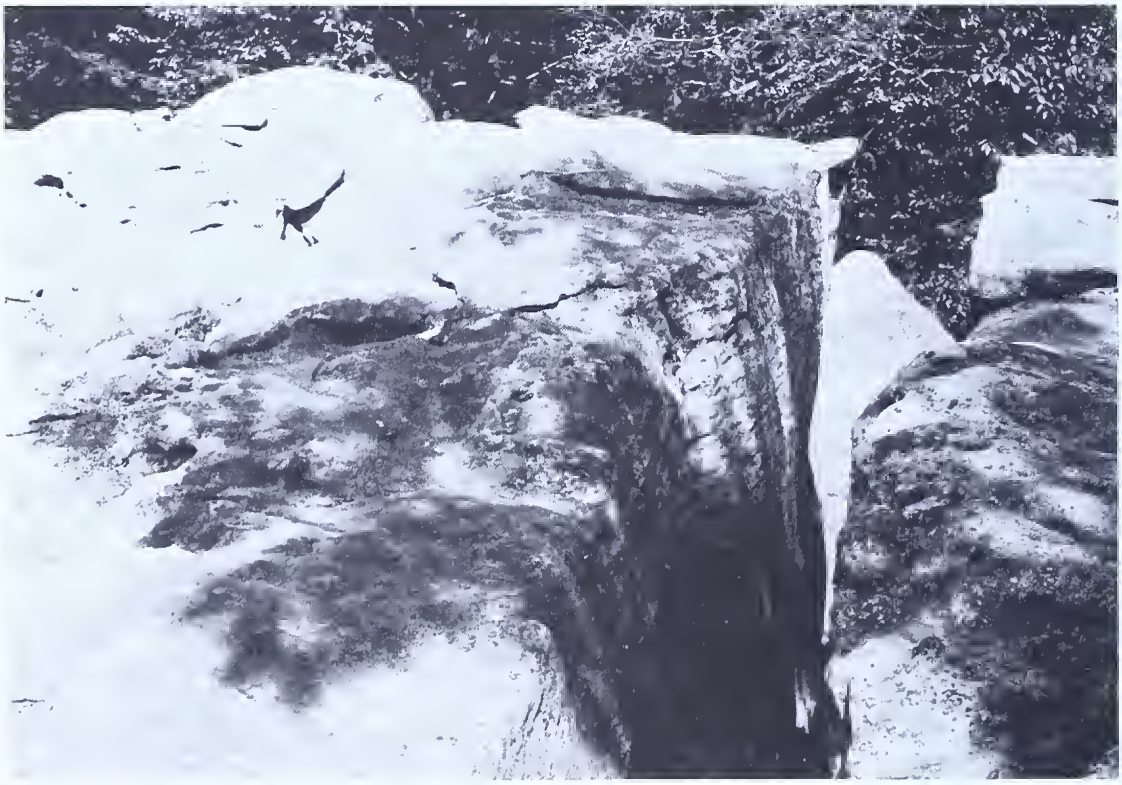
REMARKS: A large ledge and isolated blocks of white to gray sandstone and conglomerate. Pebbles in the conglomerate are small, usually less than one-half inch (Homewood Sandstone, Pottsville Group, Pennsylvanian age). The entire "rocks" open area is about 50 yards by 75 feet wide. Large rock fractures (joints) criss-cross the area, creating a small "rock city"; joint openings are 1 foot or less wide and up to 20 feet high. A wide path leads to the top of the rocks, where the visitor may jump (with care) across or step across the "streets" from one block to another.

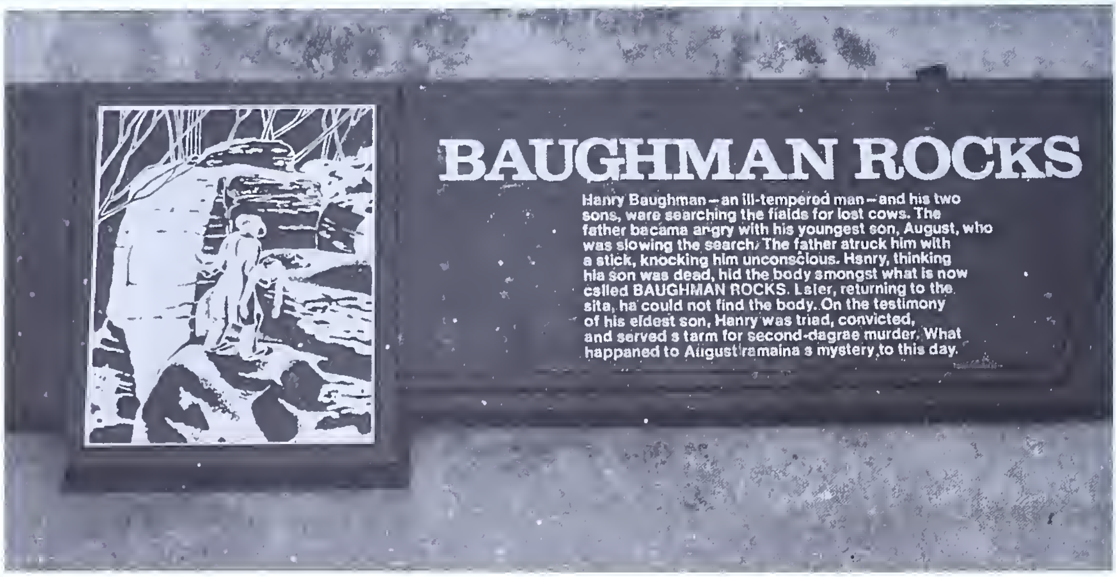


## 422. BAUGHMAN ROCKS *(continued)*

**Baughman Spring** (423) is nearby; the yield (about 2 gallons per minute) is from the sandstone and conglomerate.

REFERENCE: Pennsylvania Department of Environmental Resources, Bureau of Forestry (undated), *The Forbes State Forest public use map,* pamphlet.





BAUGHMAN ROCKS

Henry Baughman—an ill-tempered man—and his two sons, were searching the fields for lost cows. The father became angry with his youngest son, August, who was slowing the search. The father struck him with a stick, knocking him unconscious. Henry, thinking his son was dead, hid the body amongst what is now called BAUGHMAN ROCKS. Later, returning to the site, he could not find the body. On the testimony of his eldest son, Henry was tried, convicted, and served a term for second-degree murder. What happened to August remains a mystery to this day.

# 424. BLUE HOLE

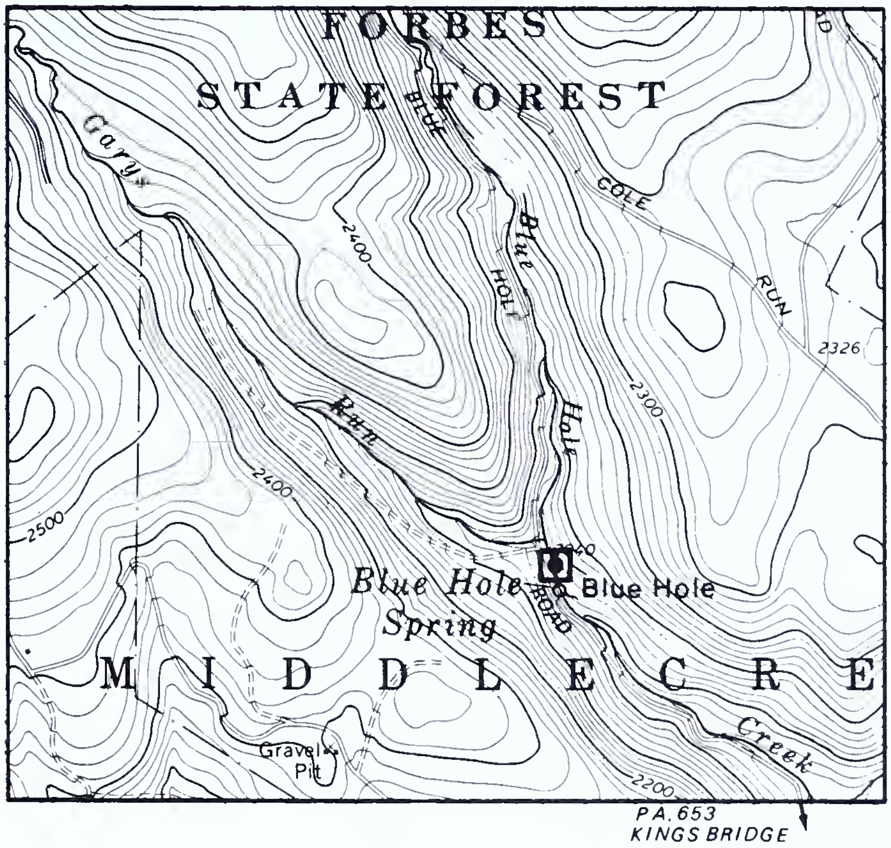
COUNTY: Somerset TOWNSHIP: Middlecreek

QUADRANGLE: Kingwood

LOCATION: Along Blue Hole Road and Blue Hole Creek in Forbes State Forest, approximately 2 miles north of Pa. Route 653 and the village of Kings Bridge.

REMARKS: Blue Hole Creek, flowing over flat-lying and cross-bedded sandstone (Pottsville Group, Pennsylvanian age), has eroded a deep pool in softer, underlying siltstones. The water in the pool is blue gray, hence the name. The site is secluded, picturesque, and easily accessible from the road.

Nearby is **Blue Hole Spring** (425), which issues from the same sandstone on the road side of the stream, runs into a natural sand-bed filter, and is

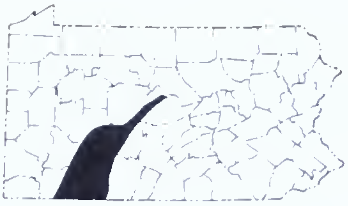


## 424. BLUE HOLE *(continued)*

piped to the stream side for public use. The yield is about 12 gallons per minute (measured July 19, 1984).

REFERENCE: Pennsylvania Department of Environmental Resources, Bureau of Forestry (undated), *The Forbes State Forest public use map,* pamphlet.

NOTES:



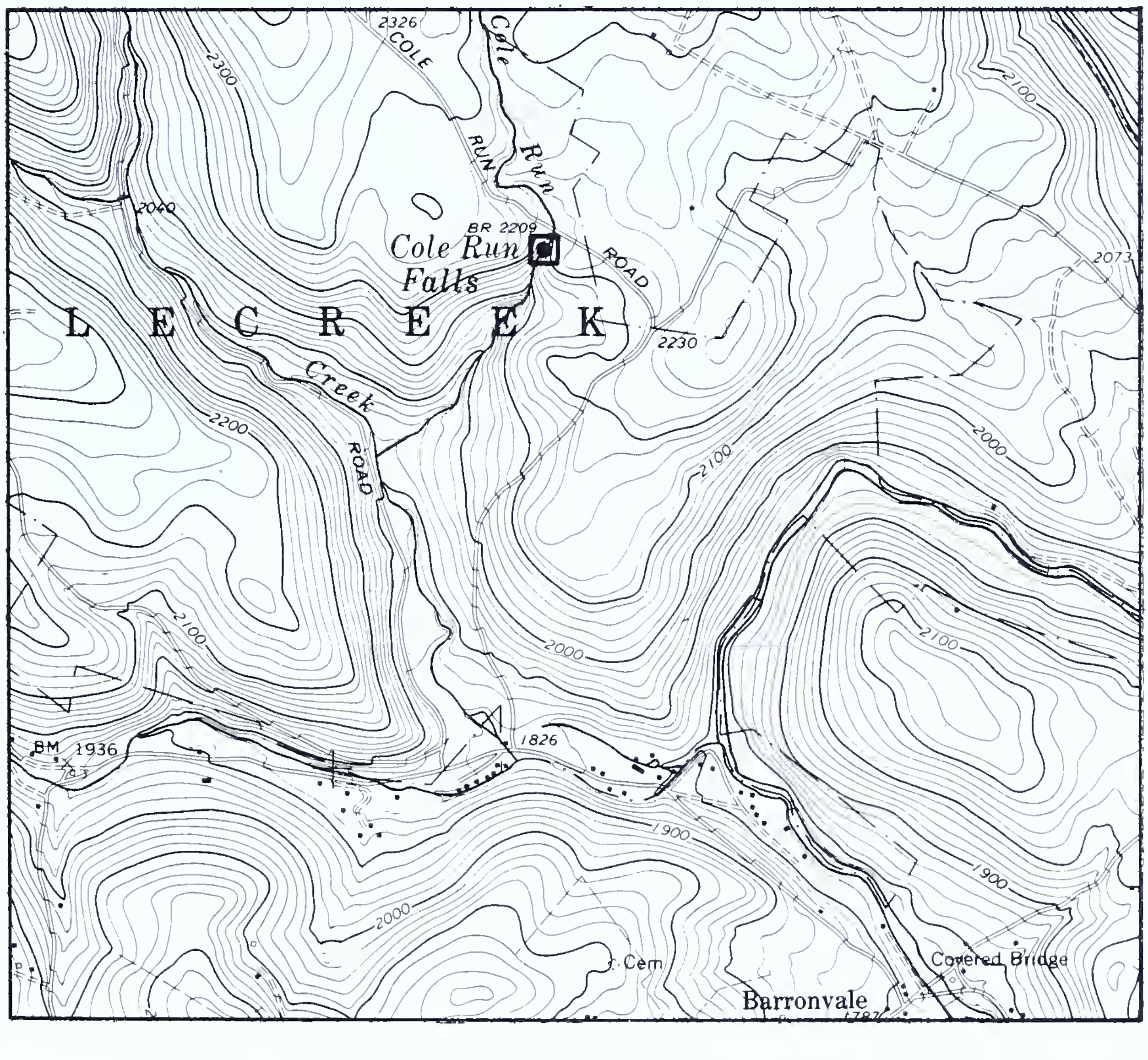
# 426. COLE RUN FALLS

COUNTY: Somerset TOWNSHIP: Middlecreek

QUADRANGLE: Kingwood

LOCATION: At the intersection of Cole Run and Cole Run Road in Forbes State Forest, about 200 feet from the road, along a marked path.

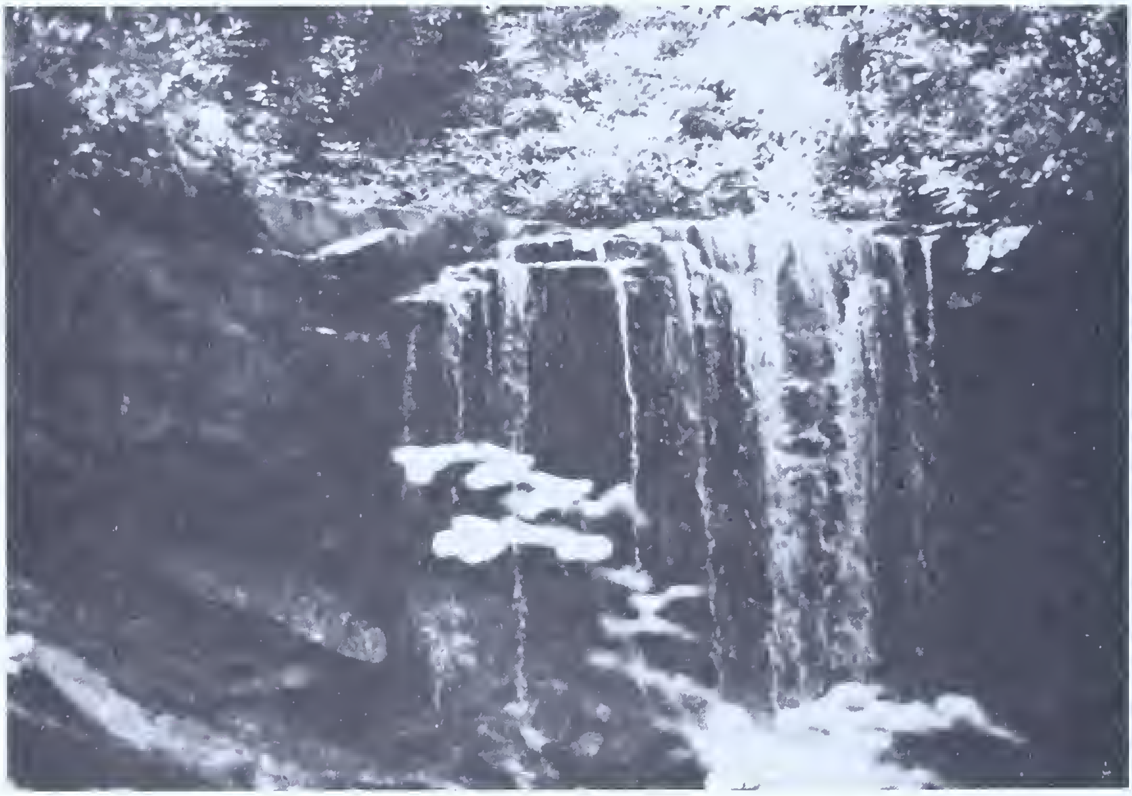
REMARKS: A remote, highly scenic falls on Cole Run. A creek cascades over flat-lying, tan sandstone (Homewood Sandstone, Pottsville Group, Pennsylvanian age) in



## 426. COLE RUN FALLS *(continued)*

two plunges of 12 feet and 8 feet. Massive sandstone ledges cap the high falls, and a similar ledge separates the two cascades.

REFERENCE: Pennsylvania Department of Environmental Resources, Bureau of Forestry (undated), *The Forbes State Forest public use map,* pamphlet.



NOTES:

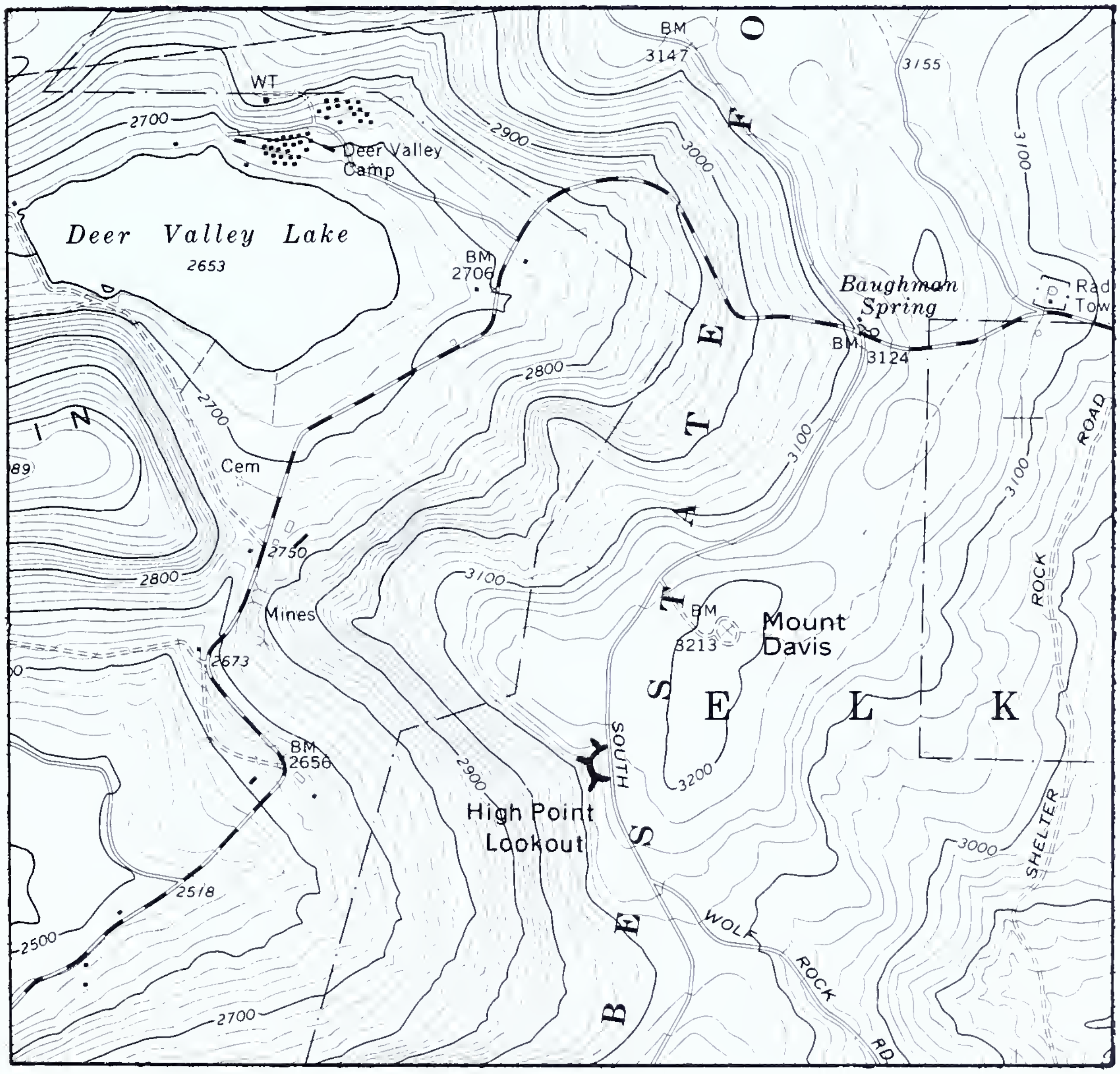
# 427. HIGH POINT LOOKOUT

COUNTY: Somerset TOWNSHIP: Elk Lick

QUADRANGLE: Markleton

LOCATION: Along South Wolf Rock Road in Forbes State Forest, about 0.4 mile southwest of Mount Davis.

REMARKS: A spectacular view of the Laurel Highlands of the Allegheny Mountains; High Point Lake is in the



## 427. HIGH POINT LOOKOUT *(continued)*

foreground and Laurel Hill is in the background. The lookout is at an elevation of 3,160 feet above sea level, one of the highest elevations in Pennsylvania.

NOTES:

# 428. PRINCE GALLITZIN SPRING

COUNTY: Blair TOWNSHIP: Allegheny

QUADRANGLE: Cresson

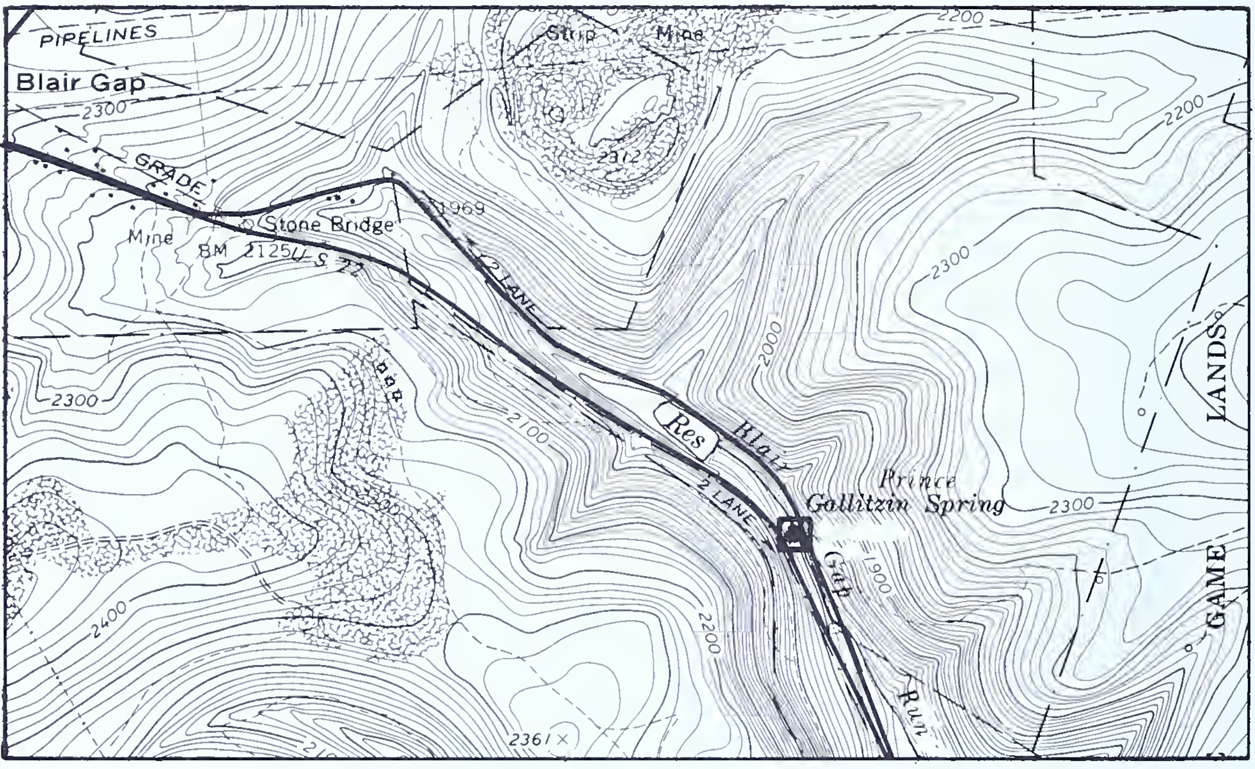
LOCATION: In Blair Gap along Blair Gap Run and U.S. Route 22 (westbound), about 3.7 miles east of the borough of Cresson.

REMARKS: Prince Gallitzin, while doing missionary work in the Allegheny Mountains, often stopped at this spring—hence its name. In 1916 a bronze plaque and stone arch were erected. The yield is about 7 gallons per minute from sandstone (Burgoon Sandstone, Mississippian age).

Prince Gallitzin, who was also known as Father Smith, founded the settlement at Loretto in 1792.

REFERENCE: Pennsylvania Historical and Museum Commission (1975), *Guide to the historical markers of Pennsylvania—Erected by the Pennsylvania Historical and Museum Commission,* 4th ed., 163 p.

## 428. PRINCE GALLITZIN SPRING *(continued)*



APPALACHIAN PLATEAUS PROVINCE

ALLEGHENY MOUNTAIN SECTION

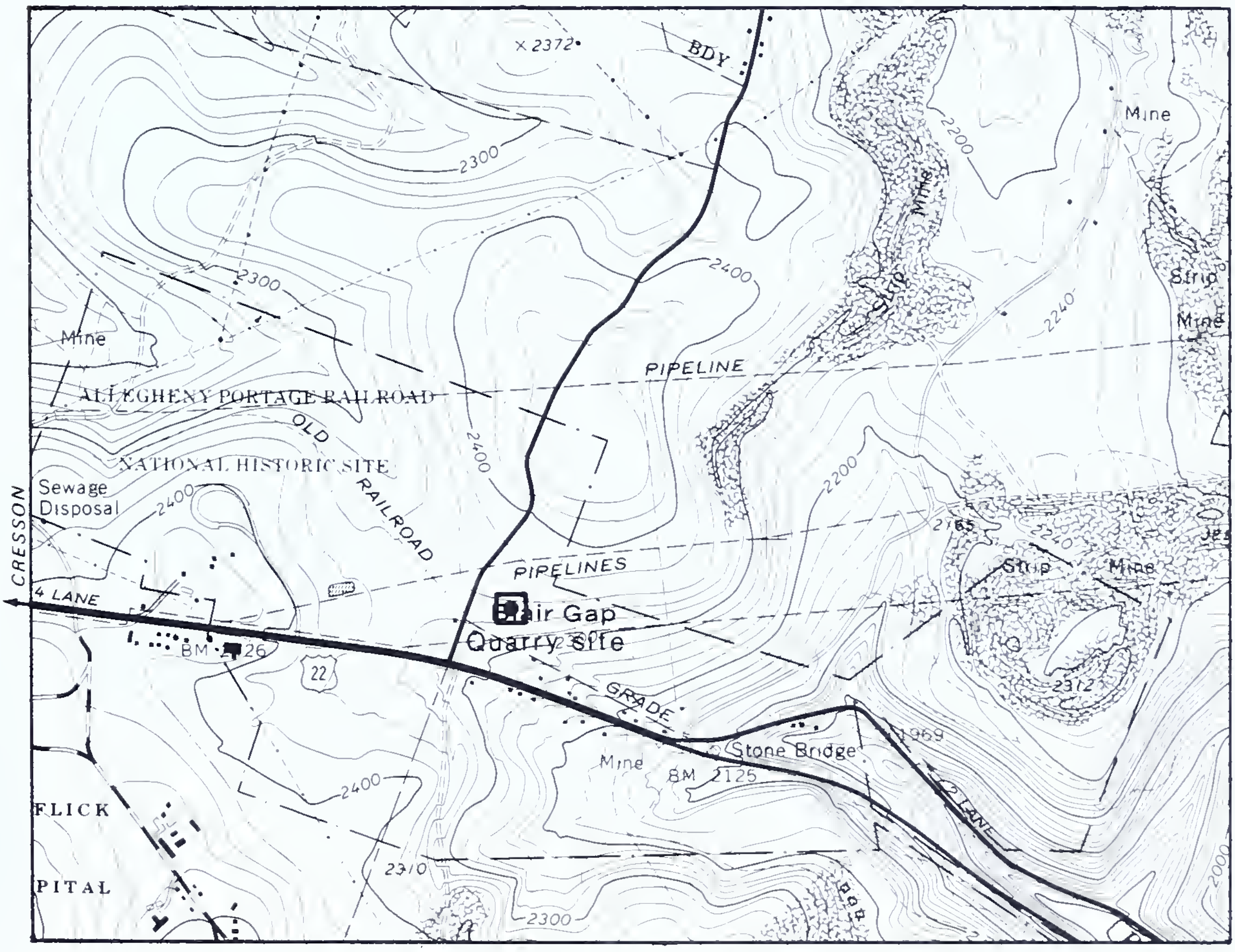
# 429. SANDSTONE QUARRY—ALLEGHENY PORTAGE RAILROAD

COUNTY: Blair TOWNSHIP: Allegheny

QUADRANGLE: Cresson

LOCATION: At the Allegheny Portage Railroad, National Historic Site, along U.S. Route 22, 2.3 miles east of the borough of Cresson; owned and operated by the National Park Service, U.S. Department of the Interior.

REMARKS: Light-tan sandstone (Mahoning sandstone, Glenshaw Formation, Pennsylvanian age) was quarried here in the early 1830's in a series of small pits. The stone



## 429. SANDSTONE QUARRY—ALLEGHENY PORTAGE RAILROAD *(continued)*

was split and shaped by hand for the nearby engine house for incline 6 of the railroad, and for "sleepers" on the railroad itself; these "sleepers" were 2-foot by 2-foot by 1-foot sandstone blocks used as foundations for the iron rails. Some homes and bridges along the railroad in this vicinity also received stone from this site.

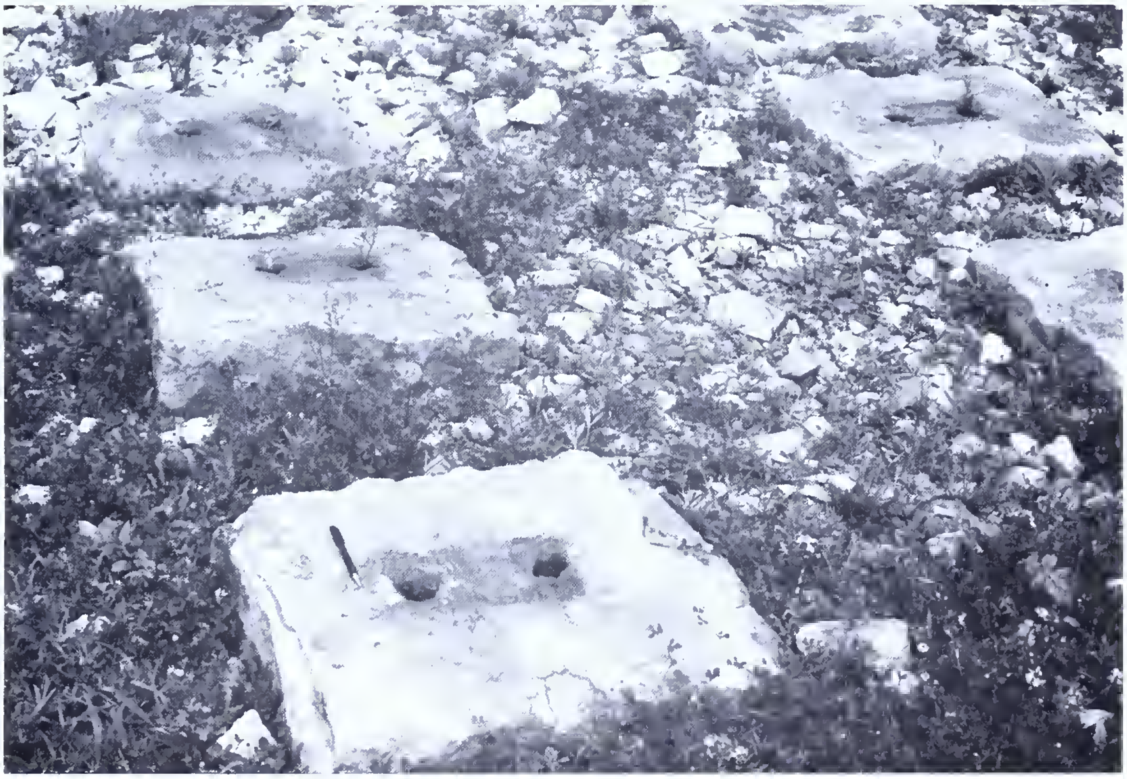
The Allegheny Portage Railroad was the first railroad to cross the Allegheny Mountains at the Allegheny Front. This portage railroad consisted of

QUARRY

10 inclined planes to lift and lower rail cars from one level to another; on the levels, locomotives pulled the cars. On a grand scale this was a set of stairs to get over the mountain.

This railroad and the people involved made history, but by 1854 the Pennsylvania Railroad completed the Horseshoe Curve and by 1855 the Allegheny Portage Railroad was abandoned, replaced by the New Portage Railroad and later by the Pennsylvania Railroad.

REFERENCE: National Park Service (1979), *Allegheny Portage Railroad, National Historic Site, Pennsylvania,* U.S. Department of the Interior, site pamphlet.



SANDSTONE "SLEEPERS"

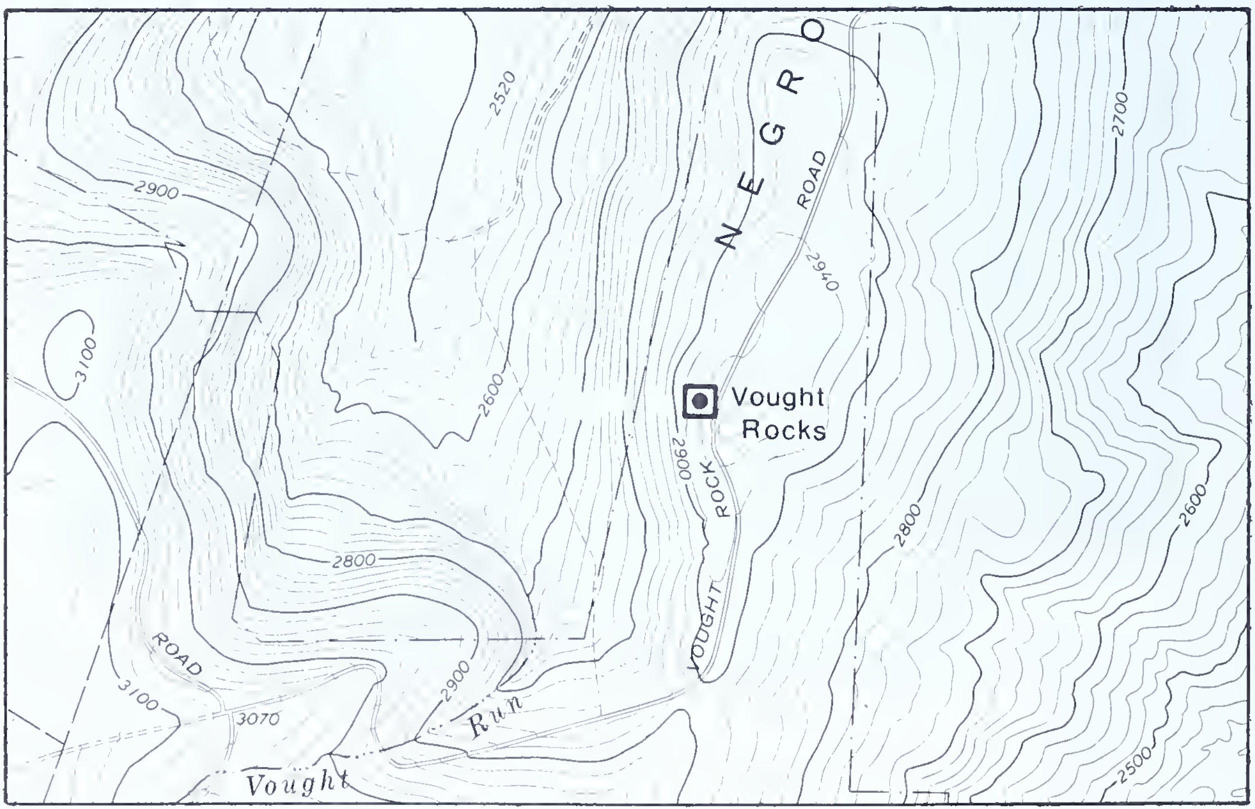
## 430. VOUGHT ROCKS

COUNTY: Somerset TOWNSHIP: Elk Lick

QUADRANGLE: Markleton

LOCATION: Along Vought Rock Road at the top of the mountain; not within Forbes State Forest but visitors are welcome; a sign marks the short trail to the rocks.

REMARKS: The site consists of several elevated ledges of rock made up of gray to brownish sandstone and conglomerate (Homewood Sandstone, Pottsville Group, Pennsylvanian age) heavily overgrown with trees and blueberry bushes in an area of about 50 feet by 100 feet. Rock fractures (joints) create long, tablelike slabs that appear to be turned on end; joint openings are 1 foot or less wide and 20 feet high. A short path from Vought Rock Road leads to the top of the rocks, where one may jump (with care) across the open fractures and look 20 feet down to the forest floor. The site is scenic, wild, remote, interesting, and unusual.



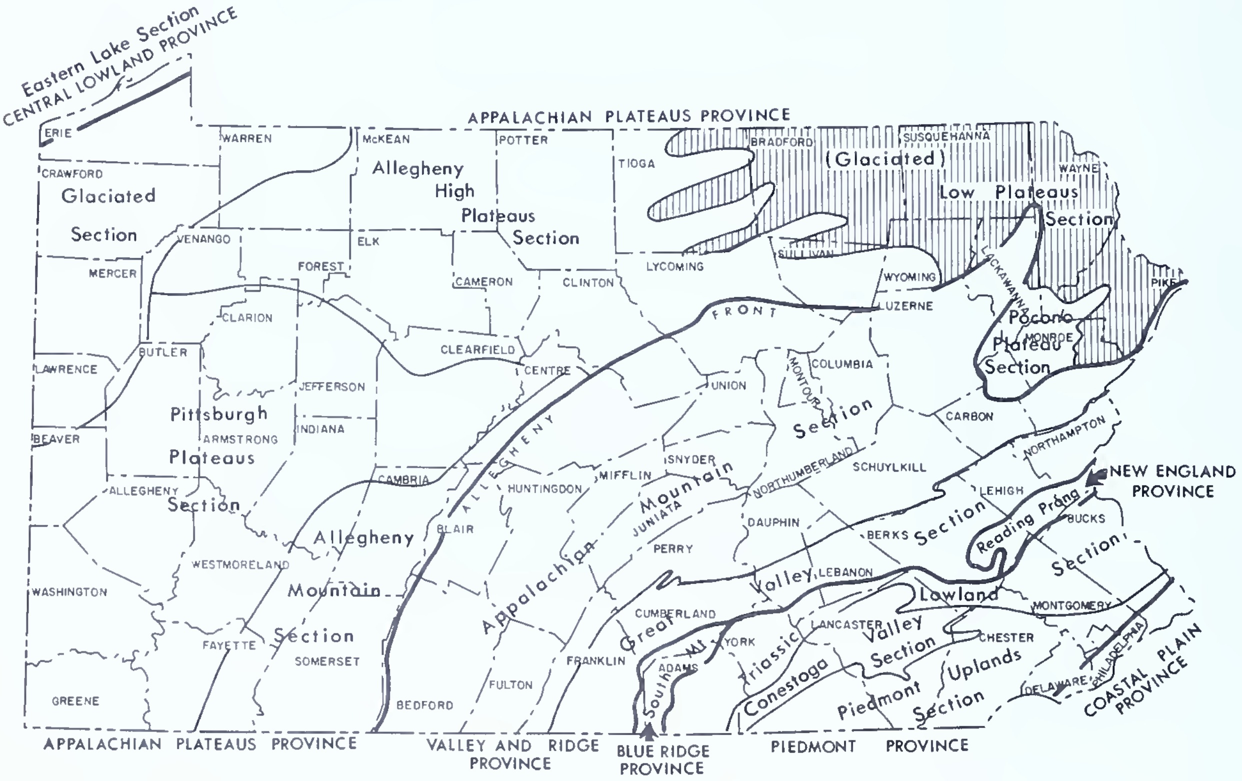
REFERENCE: Pennsylvania Department of Environmental Resources, Bureau of Forestry (undated), *The Forbes State Forest public use map,* pamphlet.

NOTES:

# APPALACHIAN PLATEAUS PROVINCE—GLACIATED LOW PLATEAUS SECTION

## *TOPOGRAPHY*

The Glaciated Low Plateaus section, as the name implies, is a glaciated plateau of moderate relief, and is located in the extreme northeastern corner of the state. The area is one of smooth, rolling hills and a large number of glacial lakes and swamps. The western area of the section slopes gently toward the Susquehanna River, whereas the eastern part slopes toward the Delaware River. The number of streams increases from west to east across the section, and some of the streams found east of the Susquehanna River have eroded deep valleys in the plateau. Elevations range from 2,100 feet in western Wayne County to as low as 500 feet along the Delaware River in Pike County.



## *ROCK COLUMN*

Glacial till and outwash deposits are found along streambeds and on hillsides. This unconsolidated material, the result of the Wisconsinan glaciation and the earlier Illinoian glaciation, is composed primarily of unsorted

sand and gravel in a matrix of clay; the material has low porosity and low permeability. Where these glacial deposits are thick and sorted there are stratified lenses of sand and/or gravel having a uniform grain size.

The most abundant rock type throughout the area is sandstone, and only in the Lock Haven Formation is shale the dominant rock type.

A description of the rock units present follows:

| SYSTEM | ROCK UNIT | DESCRIPTION |
|---|---|---|
| Quaternary | Wisconsinan drift | Sand and gravel. |
| Pennsylvanian | Allegheny Group | Sandstone, shale, clay, and coal. |
| | Pottsville Group | Gray sandstone and conglomerate and interbeds of shale and coal. |
| Mississippian | Mauch Chunk Formation | Red and green shale and sandstone. |
| | Pocono Formation | Gray sandstone and conglomerate. |
| Mississippian and Devonian | Spechty Kopf Formation | Light- to olive-gray, fine- to medium-grained, crossbedded sandstone, siltstone, and pebbly mudstone in fining-upward cycles; local conglomerate. |
| Devonian | Catskill Formation | Red to brown sandstone and shale. |
| | Lock Haven Formation | Gray shale, sandy shale, and sandstone. |
| | Trimmers Rock Formation | Olive-gray siltstone and silty shale; very fine grained sandstone locally. |

## *ROCK STRUCTURE*

Four anticlines form the major structural features of the physiographic section. The axes of these anticlines trend 40 to 50°E, and they have a shallow plunge that results in the termination of their surface expression and the exposure of successively younger formations. Three of the anticlines extend across Tioga County and the fourth extends into Sullivan County.

The primary folded structures, from north to south across Tioga and Bradford Counties, are the (1) Wellsboro anticline, (2) Windham syncline, (3) Rome anticline, (4) Blossburg syncline, (5) Towanda anticline, (6) Barclay syncline, and (7) Wilmot anticline. All of the folds disappear to the east and the rocks become nearly horizontal.

Surface evidence of major faulting is lacking; however, faulting on a local scale is present in Bradford County. The few faults that are seen are parallel to the anticlines.

## 431. BUTTERMILK FALLS

COUNTY: Wyoming TOWNSHIP: Falls

QUADRANGLE: Ransom

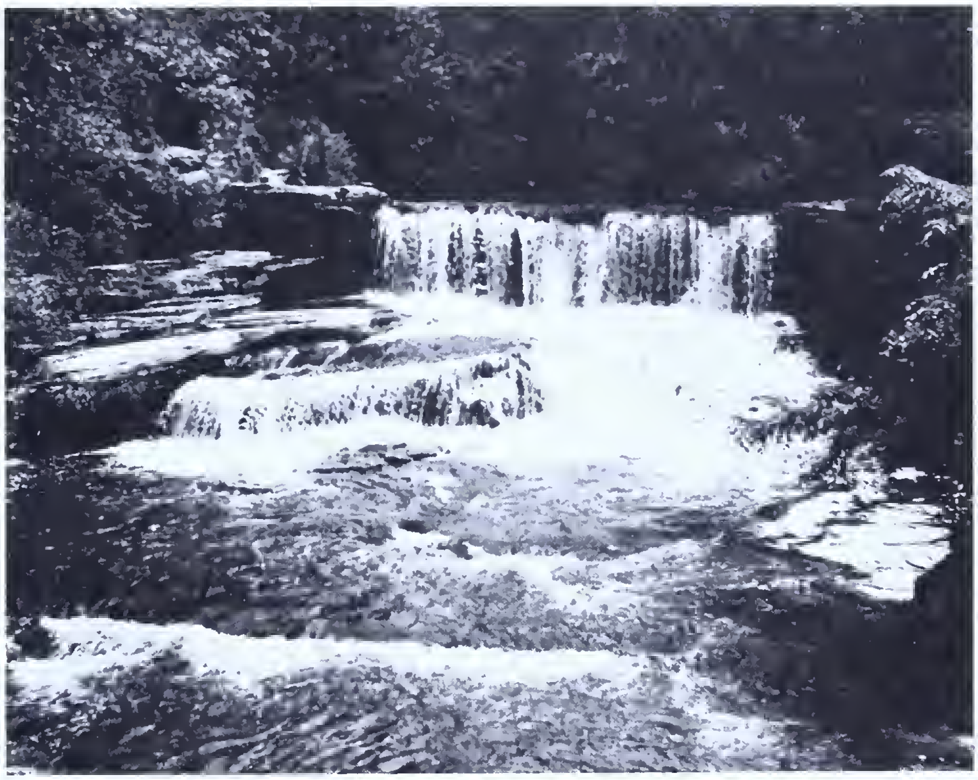
LOCATION: In the village of Falls where Buttermilk Creek enters the Susquehanna River, about 10 miles north of Pittston.

REMARKS: About 0.3 mile from the mouth of Buttermilk Creek is a series of falls of 10, 15, and 25 feet over flat-lying, gray flagstone (sandstone of the Catskill Formation, Devonian age) in a horizontal distance of 200 yards. These falls are in a very scenic hemlock gorge; a path along the stream through the hemlocks adds to the beauty of the site.

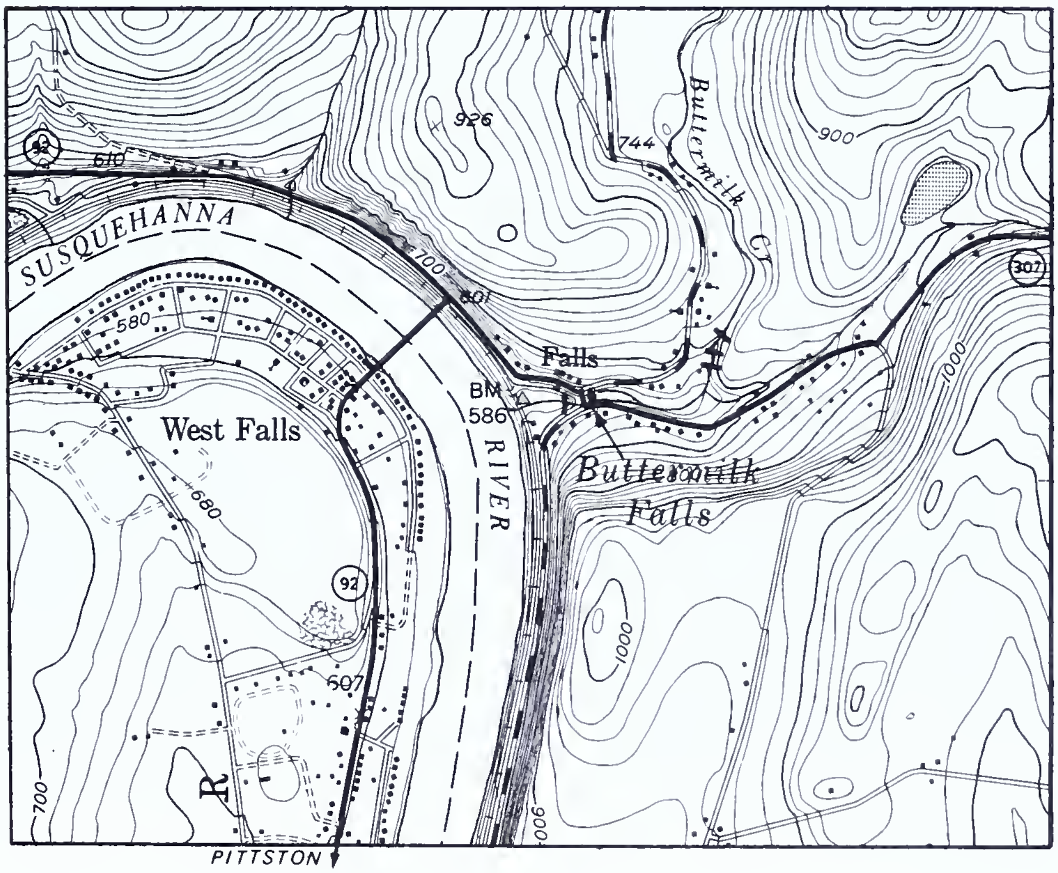
Near the mouth, on both sides of the bridge over Buttermilk Creek in the village, are two other beautiful cascades of 20 and 35 feet.

This short stretch of stream with its many spectacular individual waterfalls is perhaps the most outstanding example of its kind in Pennsylvania.

BUTTERMILK FALLS



FALLS IMMEDIATELY EAST OF THE BRIDGE



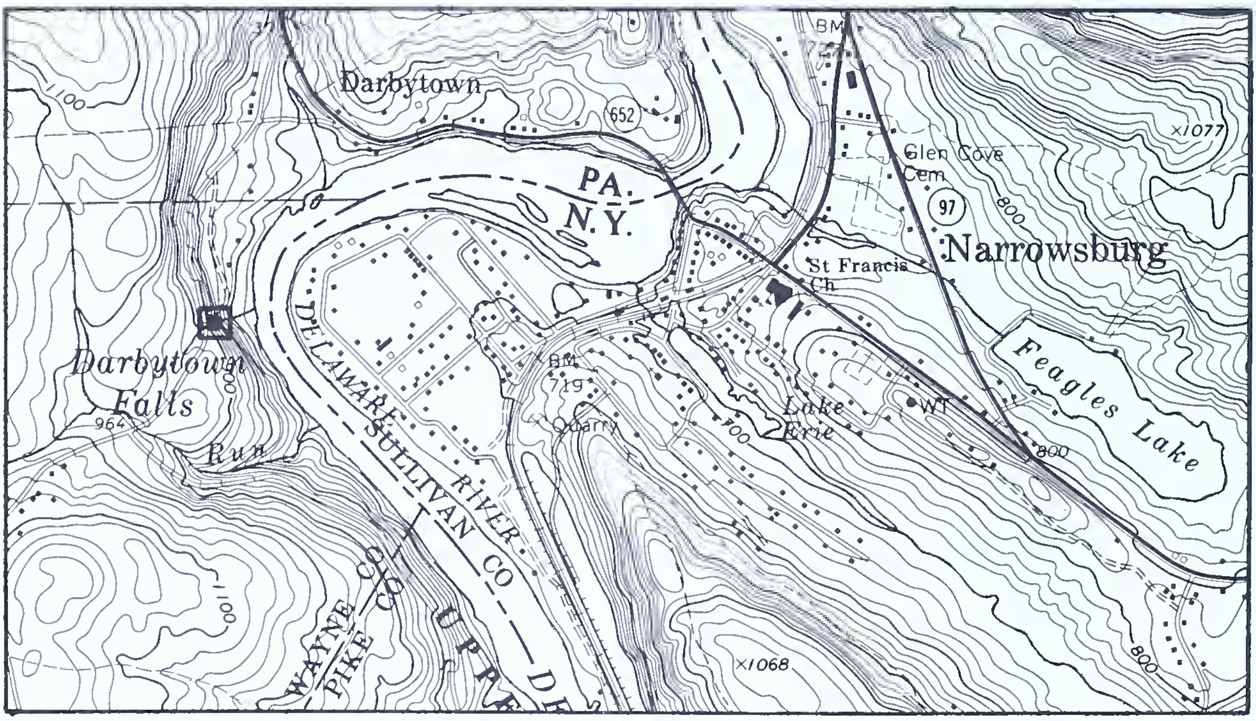
## 432. DARBYTOWN FALLS

COUNTY: Wayne TOWNSHIP: Berlin

QUADRANGLE: Narrowsburg

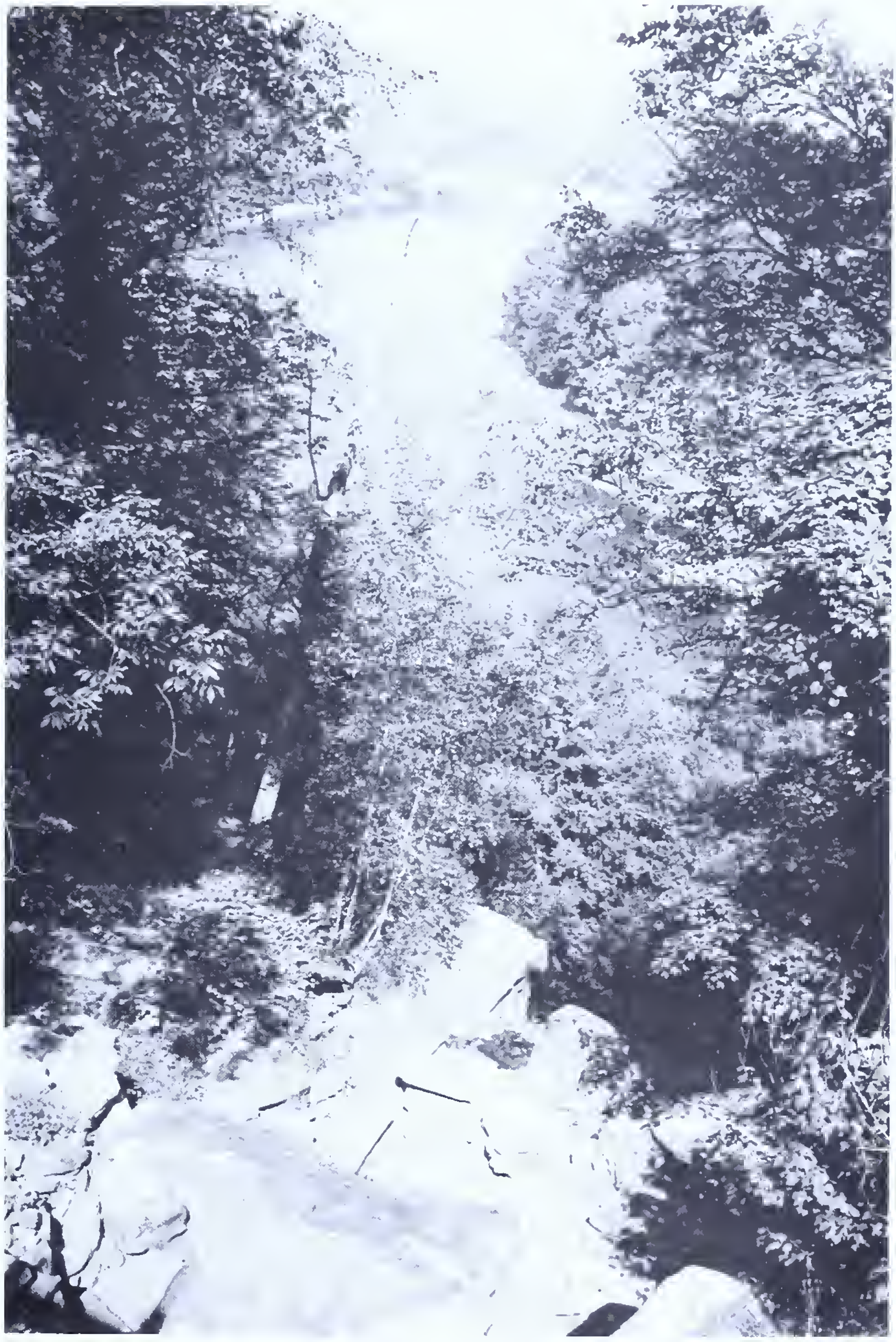
LOCATION: In the village of Darbytown, along the Delaware River, 0.9 mile west of Narrowsburg, New York.

REMARKS: A small stream at this site plunges over the rim of a high cliff along the Delaware River; the water falls about 200 feet vertically and may be the highest single waterfall in Pennsylvania. A scenic gorge has been developed by the stream as it approaches the lip at the falls. Trees and other vegetation have been eroded away, and the rock cliff and waterfall are visible from the highway (Pa. Route 652) below and the Fish Commission's boat landing site opposite Narrowsburg. The site is also known as the **Narrowsburg Falls**. The falls plunges over flat-lying beds of siltstone and sandstone of the Catskill Formation (Devonian age).



## APPALACHIAN PLATEAUS PROVINCE

## GLACIATED LOW PLATEAUS SECTION



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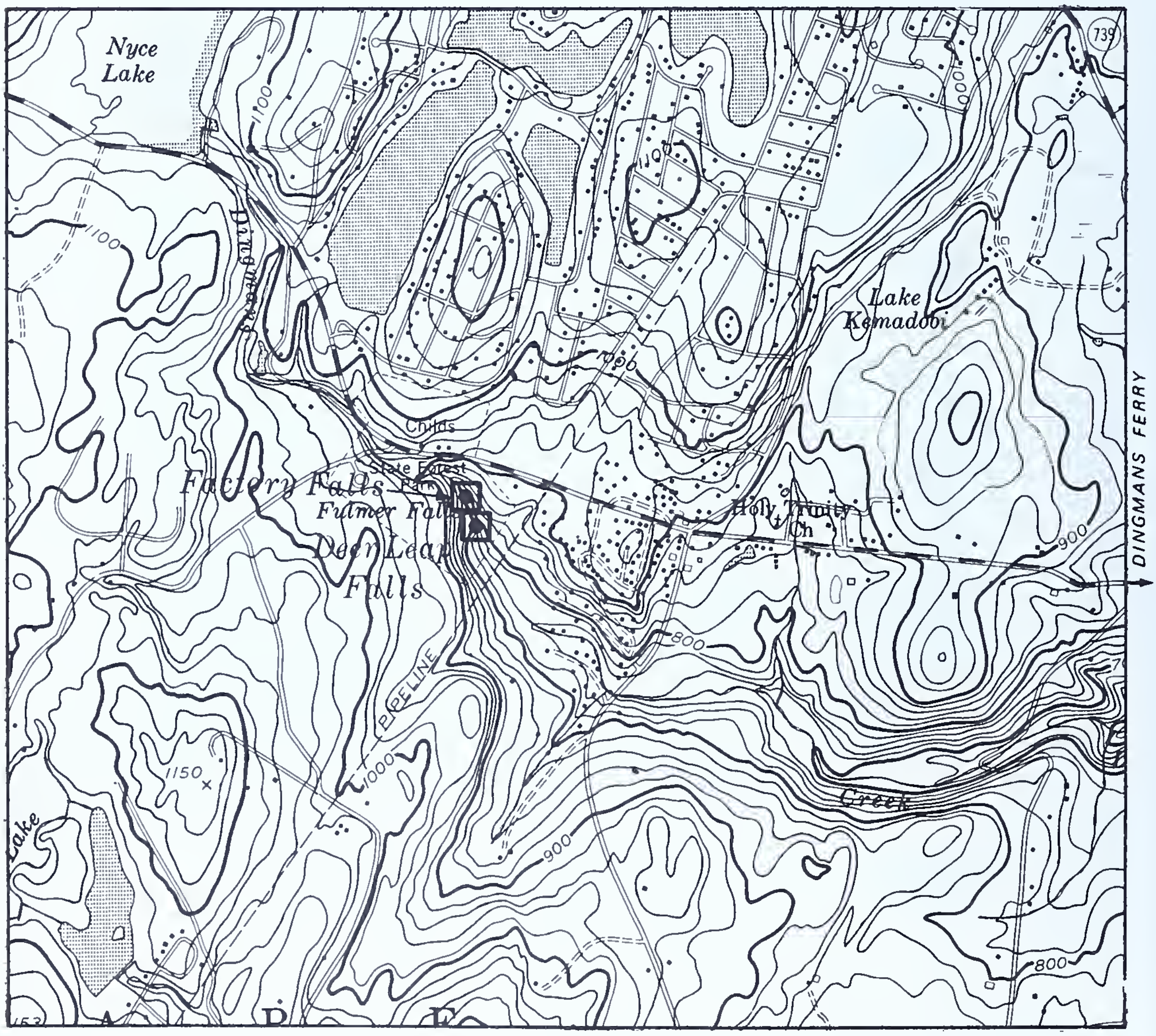
# 433. DEER LEAP FALLS

COUNTY: Pike TOWNSHIP: Delaware

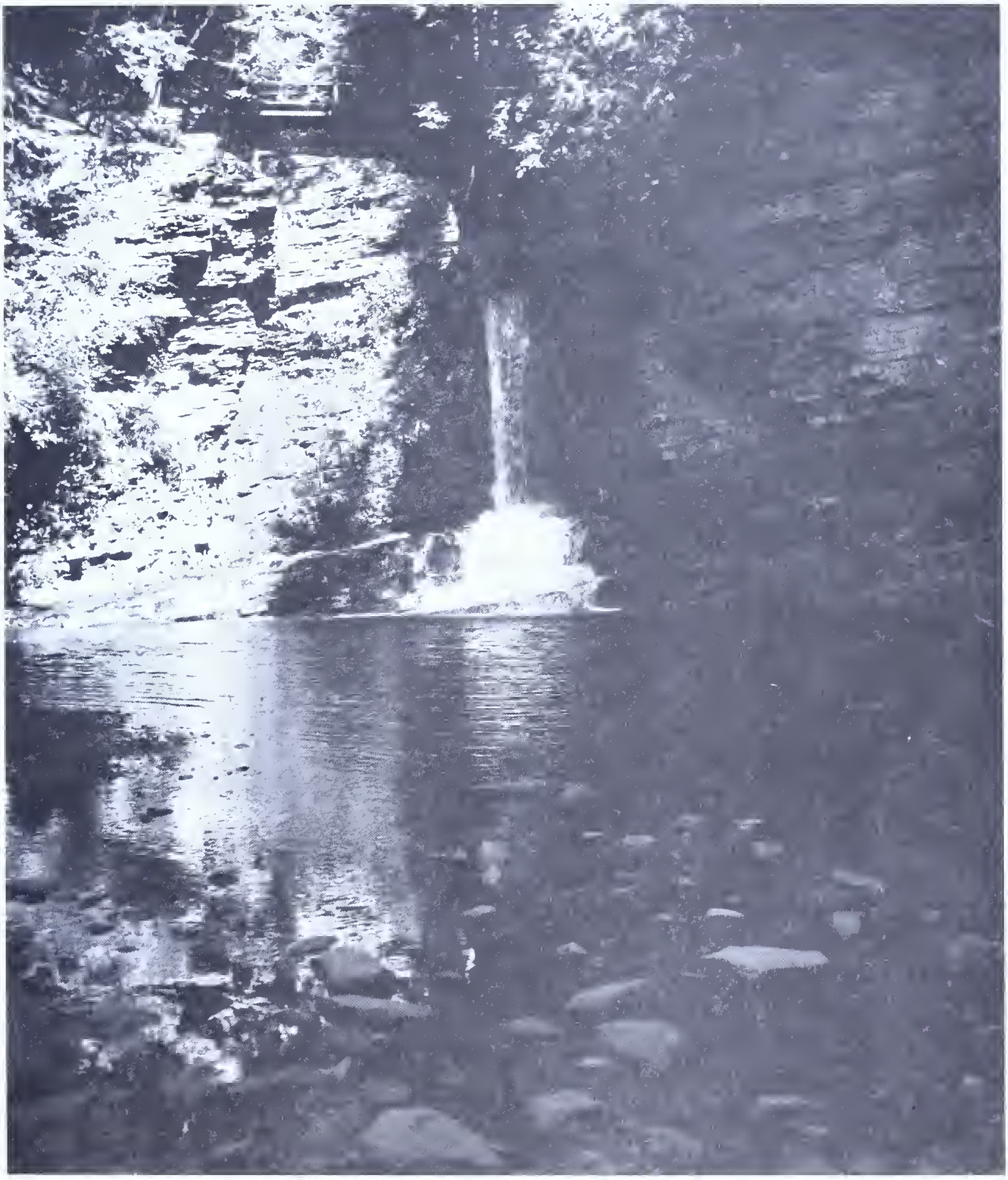
QUADRANGLE: Lake Maskenozha

LOCATION: Three miles west of the village of Dingmans Ferry; within Childs State Park on Dingmans Creek.

REMARKS: Deer Leap Falls is the lower of three falls located along Dingmans Creek in the park. The stream drops 40 feet straight down over a ledge of sandstone (Trimmers Rock Formation, Devonian age) and spreads out



into a pool. The upper of the three falls is **Factory Falls** (434); the middle falls is **Fulmer Falls** (site 153 in EG 7, Part 1).



DEER LEAP FALLS

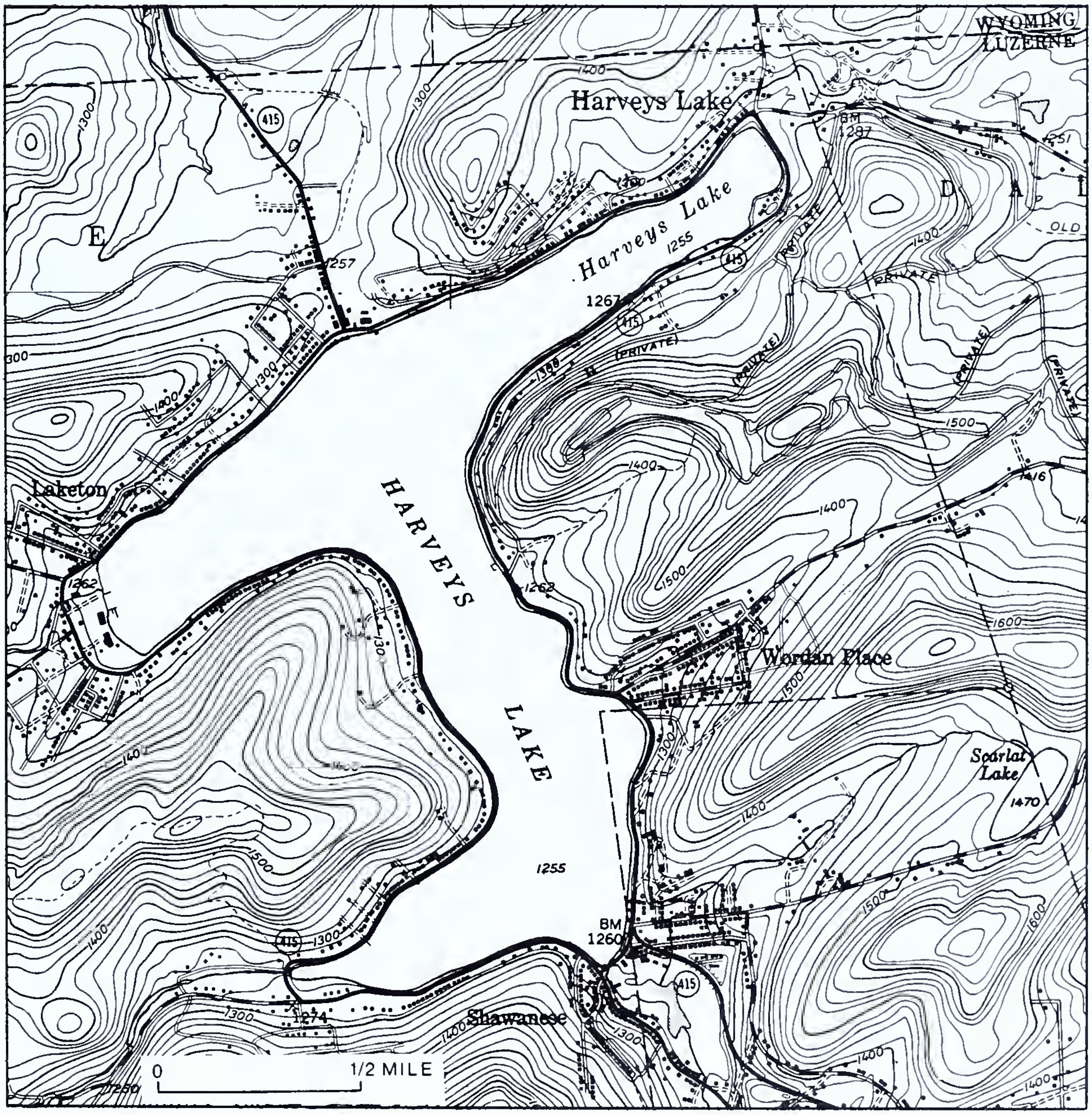
## 433. DEER LEAP FALLS *(continued)*

# 435. HARVEYS LAKE

COUNTY: Luzerne TOWNSHIP: Lake

QUADRANGLES: Harveys Lake and Noxen

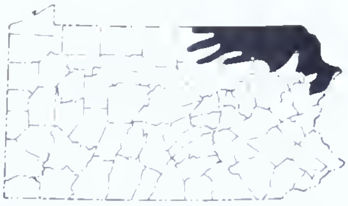
LOCATION: Adjacent to Pa. Route 415, between the villages of Harveys Lake, Wordan Place, Shawanese, and Laketon.



## 435. HARVEYS LAKE *(continued)*

REMARKS: Harveys Lake is eastern Pennsylvania's largest natural lake; it has a 9-mile scenic shoreline.

NOTES:



# 436. MARSHALLS FALLS

COUNTY: Monroe TOWNSHIP: Smithfield

QUADRANGLE: East Stroudsburg

LOCATION: Along Marshalls Creek, about 1 mile from the village of Marshalls Creek, on a privately owned estate.

REMARKS: Marshalls Falls is easily accessible, yet remotely secluded in a hemlock and rock setting. The creek plunges almost 35 feet vertically into a deep pool between massive overhanging rock cliffs; the siltstone (Mahantango Formation, Devonian age) of the cliffs contains fossils.

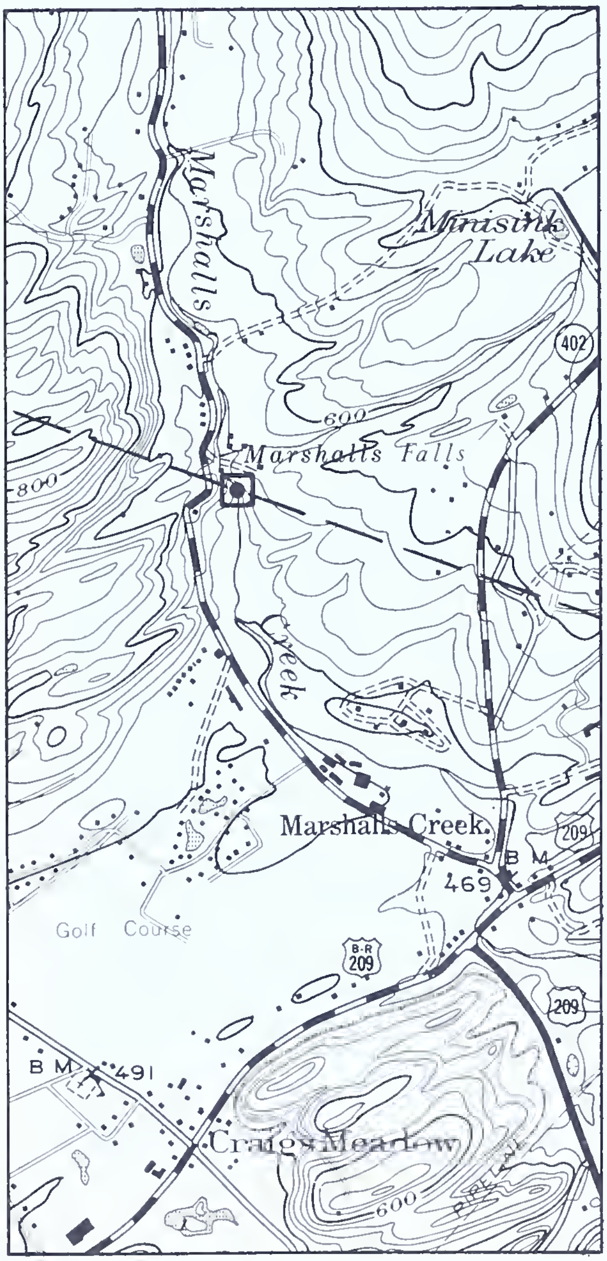
Marshalls Falls is on a privately owned estate; the grounds are very beautiful, and a bridge below the falls has been maintained for visitors. A small fee is charged to visit.

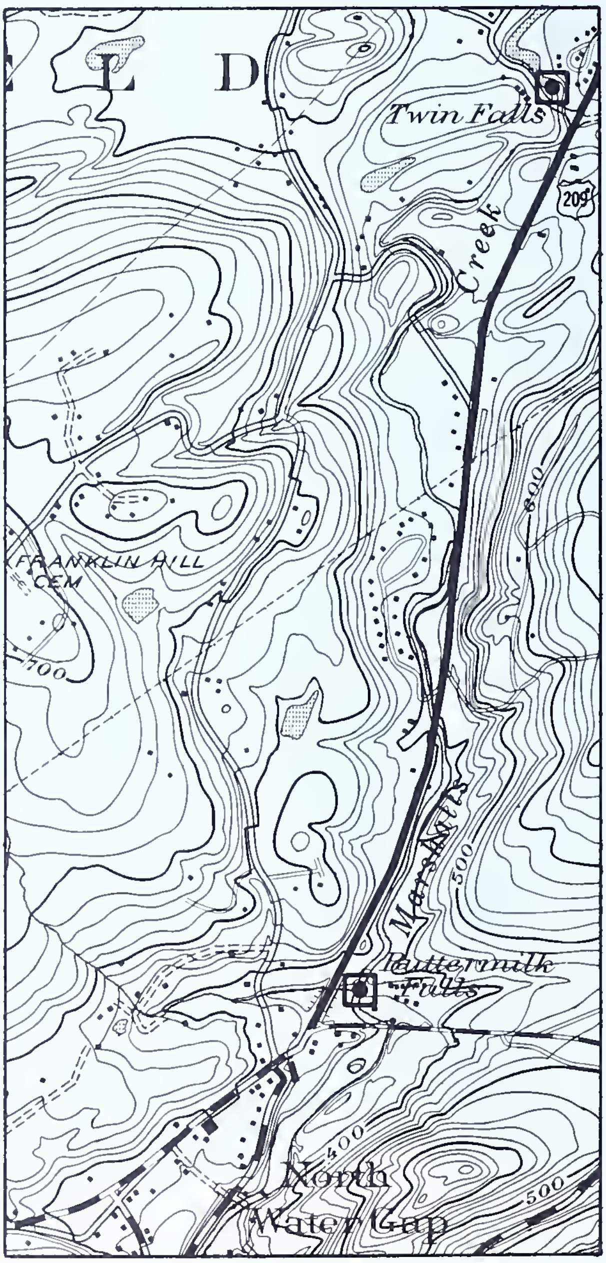
MARSHALLS FALLS

## 436. MARSHALLS FALLS *(continued)*

**Buttermilk Falls** (437), several miles to the south, has a gradual drop of about 30 feet over limestone (Buttermilk Falls Formation, Devonian age); the falls may be viewed from a bridge over Marshalls Creek. **Twin Falls** (438), **Clarke Falls** (439), and **Lee Falls** (440) are also nearby.

REFERENCE: Carswell, L. D., and Lloyd, O. B., Jr. (1979), *Geology and groundwater resources of Monroe County, Pennsylvania,* Pennsylvania Geological Survey, 4th ser., Water Resource Report 47, 61 p.

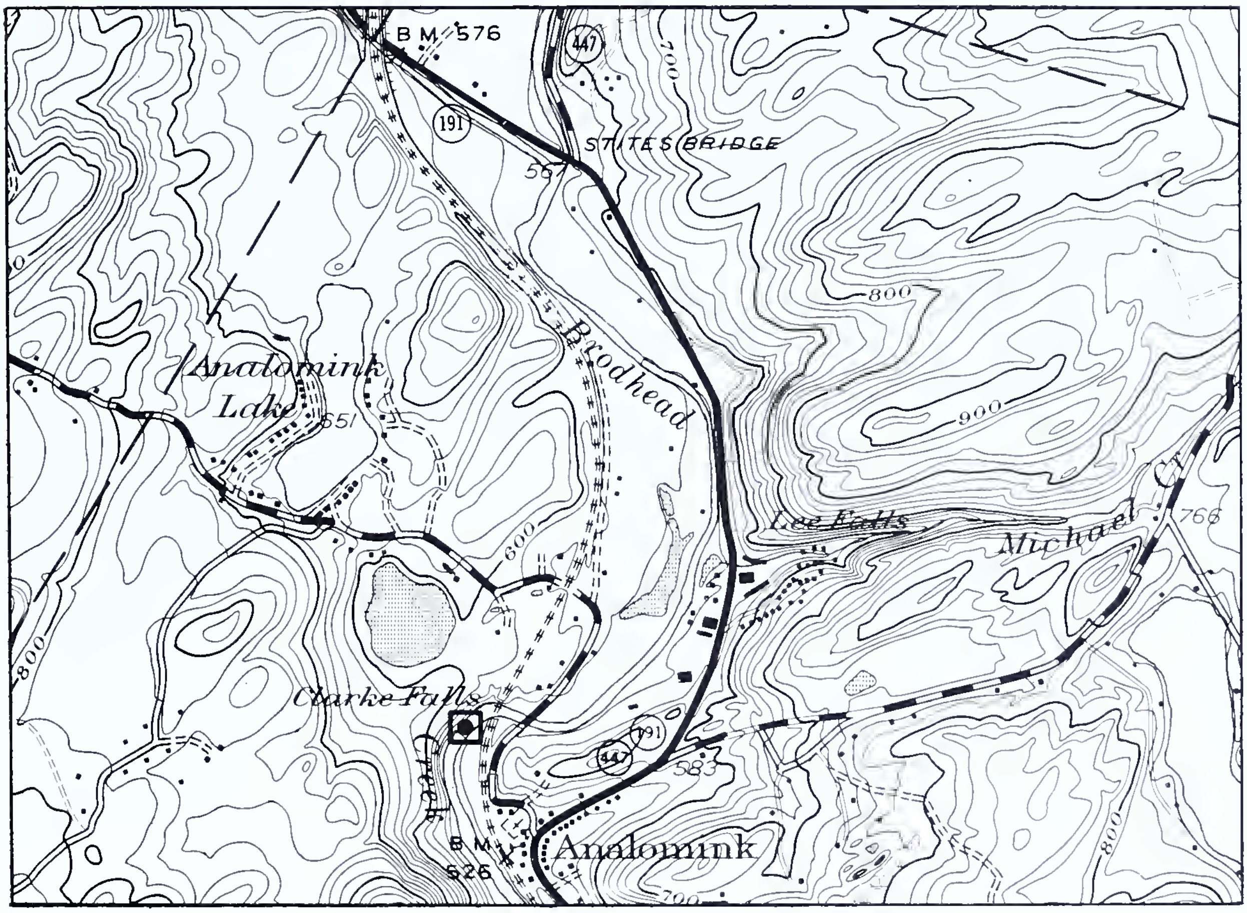




APPALACHIAN PLATEAUS PROVINCE

GLACIATED LOW PLATEAUS SECTION

BUTTERMILK FALLS



## 441. SNOW HILL FALLS

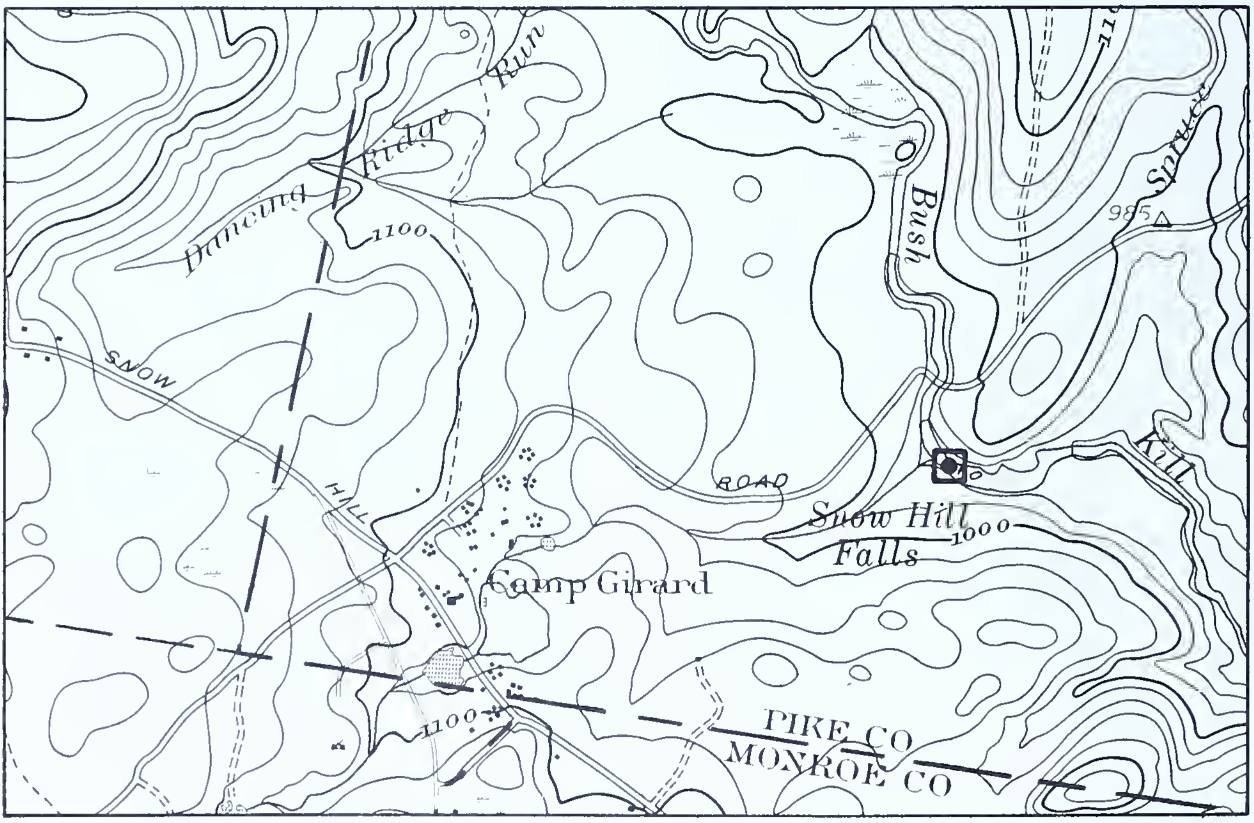
COUNTY: Pike TOWNSHIP: Porter

QUADRANGLE: Skytop

LOCATION: About one-half mile north of the Pike-Monroe County line on Bush Kill, 3.5 miles north of Resica Falls (site 261 in EG 7, Part 1).

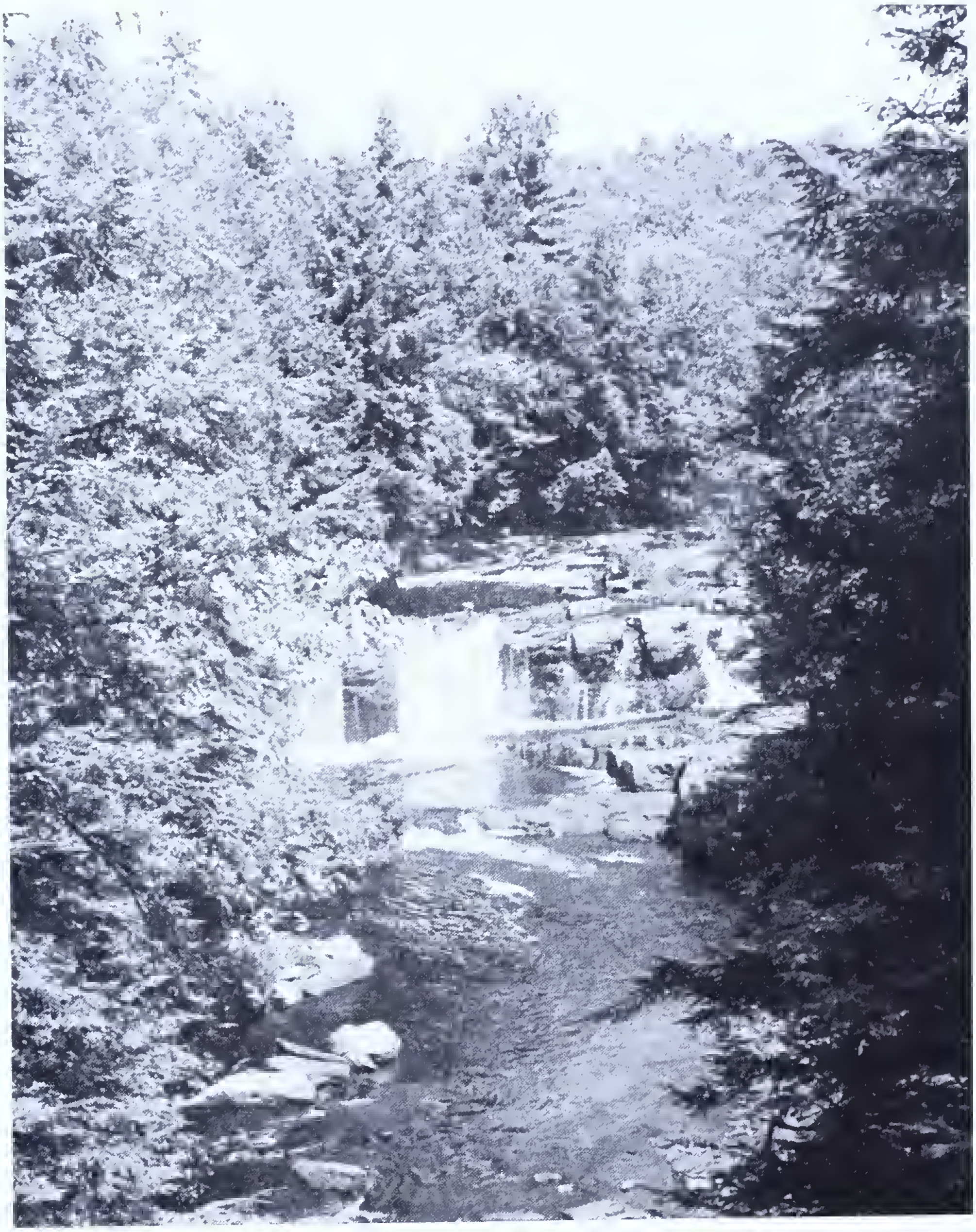
REMARKS: Bush Kill plunges over massive sandstones of the Catskill Formation (Long Run Member, Devonian age) in one 20-foot drop.

REFERENCE: Sevon, W. D., and Berg, T. M. (1978), *Geology and mineral resources of the Skytop quadrangle, Monroe and Pike Counties, Pennsylvania,* Pennsylvania Geological Survey, 4th ser., Atlas 214a, 33 p.



APPALACHIAN PLATEAUS PROVINCE

GLACIATED LOW PLATEAUS SECTION



NOTES:

## 442. WANGUM FALLS

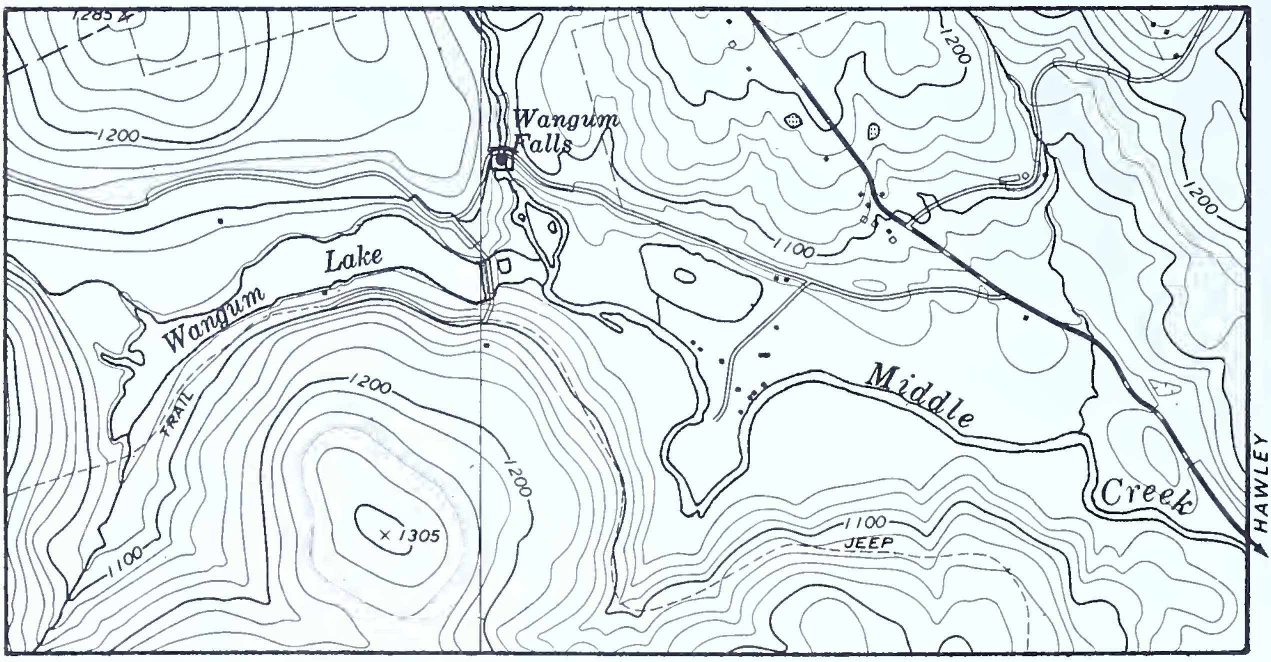
COUNTY: Wayne TOWNSHIP: Palmyra

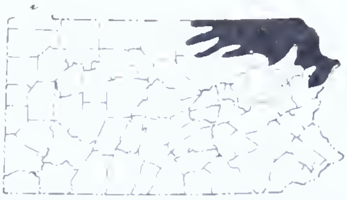
QUADRANGLE: Hawley

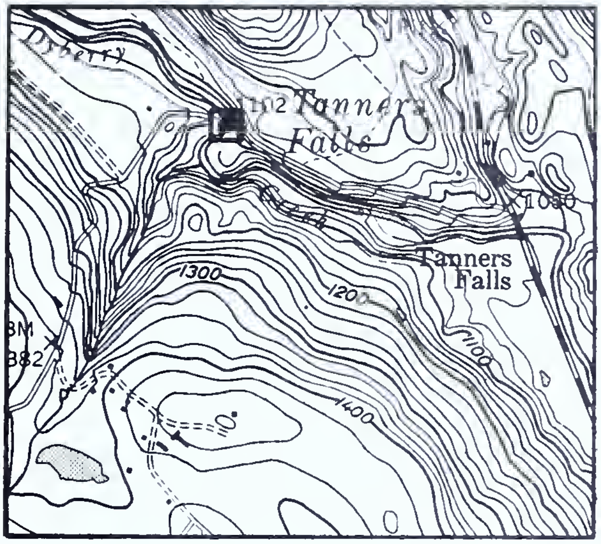
LOCATION: Along Middle Creek, about 3.6 miles northwest of the borough of Hawley, at the bridge.

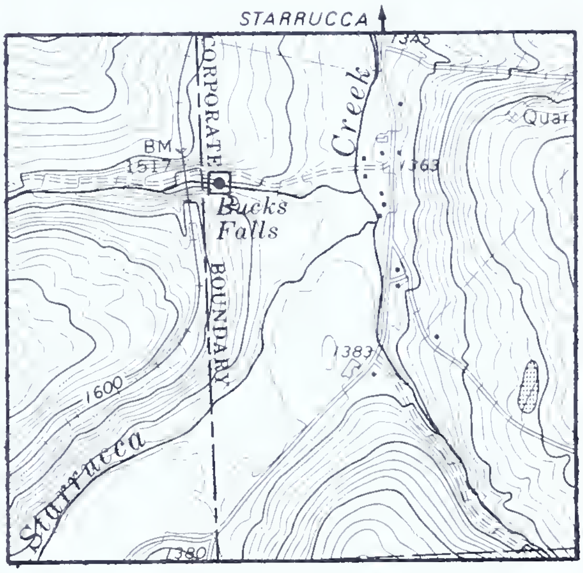
REMARKS: Middle Creek plunges about 35 feet vertically over flaggy-bedded, gray and red sandstone (Catskill Formation, Long Run Member, Devonian age). The creek here is entrenched in a ravine developed along a vertical joint (fracture) that has eroded to 40 feet in width. Large-scale crossbeds are visible in the walls of the highly scenic ravine. Land surrounding the falls is private and is protected by the Wangum Falls Association.

Several miles to the north there are two similar falls of lesser magnitude: **Tanners Falls** (443) (Dyberry Township, Aldenville quadrangle), about 20 feet high, and **Bucks Falls** (444) (Starrucca Borough, Starrucca quadrangle), about 10 feet high.









WANGUM FALLS

## 442. **WANGUM FALLS** *(continued)*

TANNERS FALLS

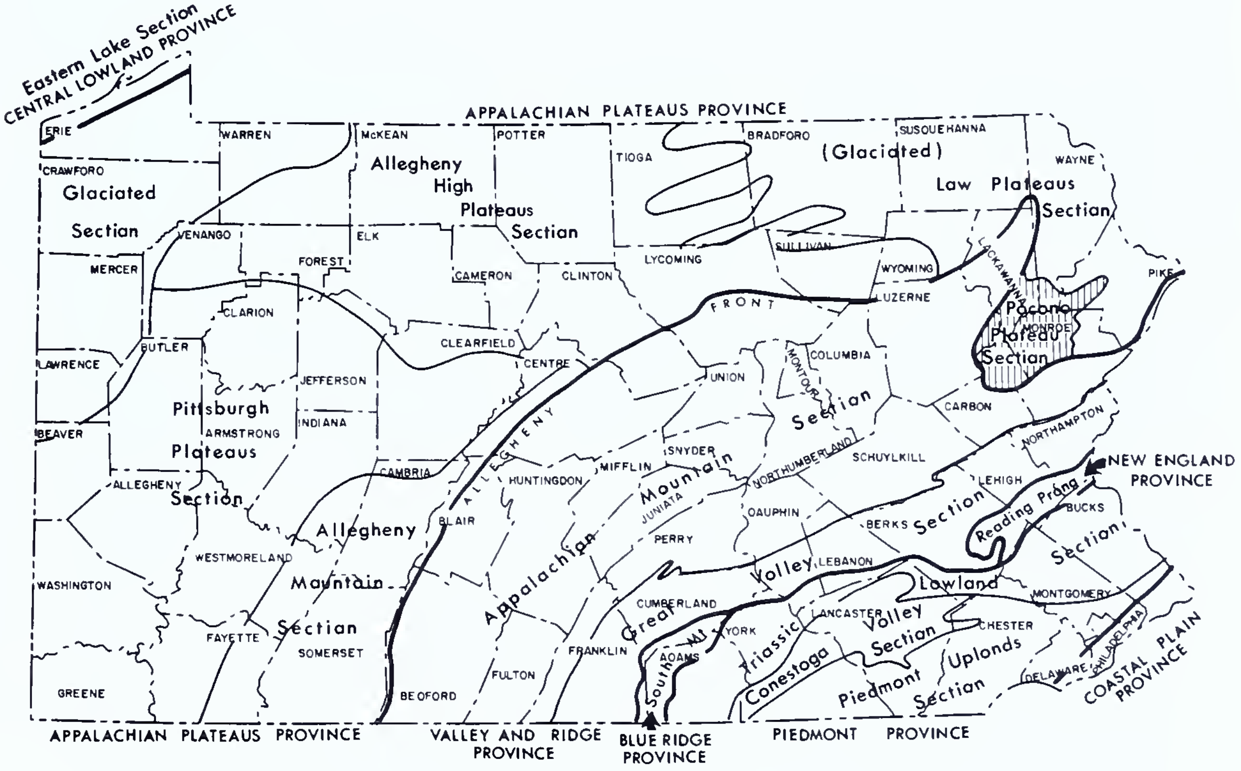
NOTES:

# APPALACHIAN PLATEAUS PROVINCE—POCONO PLATEAU SECTION

## *TOPOGRAPHY AND ROCK STRUCTURE*

The Pocono Plateau is located in the extreme southeastern corner of the Appalachian Plateaus province. Its scenic eastern rim towers about 1,000 feet above the surrounding countryside.

The plateau is known as the "Pocono Mountains." The term mountain is, of course, incorrect but has become so ingrained in common usage that the name will no doubt continue to be used. The rocks have a relatively low dip toward the east, resulting in a gently sloping rock structure in the plateau. The topographic relief within the plateau is low and seldom exceeds 100 feet. Slopes are generally low, and the entire section has been glaciated. The principal expression of ground moraine on most of the plateau is subtle and almost featureless; the main topographic interruptions are stream valleys and occasional bedrock ridges that protrude through the moraine. Between the Lehigh River and Camelback Mountain, the Woodfordian "terminal moraine" is the most striking glacial feature in northeastern



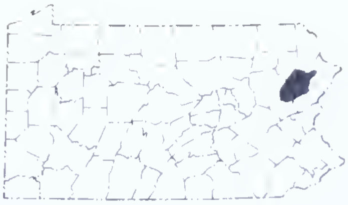
Pennsylvania. In the area of the plateau, the end moraine is a well-defined belt averaging a mile in width and characterized by an almost trackless maze of hummocky topography. Local relief varies from 10 to 100 feet. Undrained depressions, frequently containing swamps and peat bogs, are common.

## *ROCK COLUMN*

The rocks of the Pocono Plateau are of Mississippian and Devonian age and consist of shales, sandstones, and conglomerates.

A description of the rock units follows:

| SYSTEM | ROCK UNIT | DESCRIPTION |
|---|---|---|
| Mississippian | Mauch Chunk Formation | Red shale and brown and greenish-gray sandstone. |
| | Pocono Formation | Gray hard conglomerate, sandstone, and some shale. |
| Mississippian and Devonian | Spechty Kopf Formation | Light- to olive-gray, fine- to medium-grained, crossbedded sandstone, siltstone, and pebbly mudstone in fining-upward cycles. Local conglomerate. |
| Devonian | Catskill Formation | Reddish-brown shale and sandstone; some gray and greenish sandstone. |



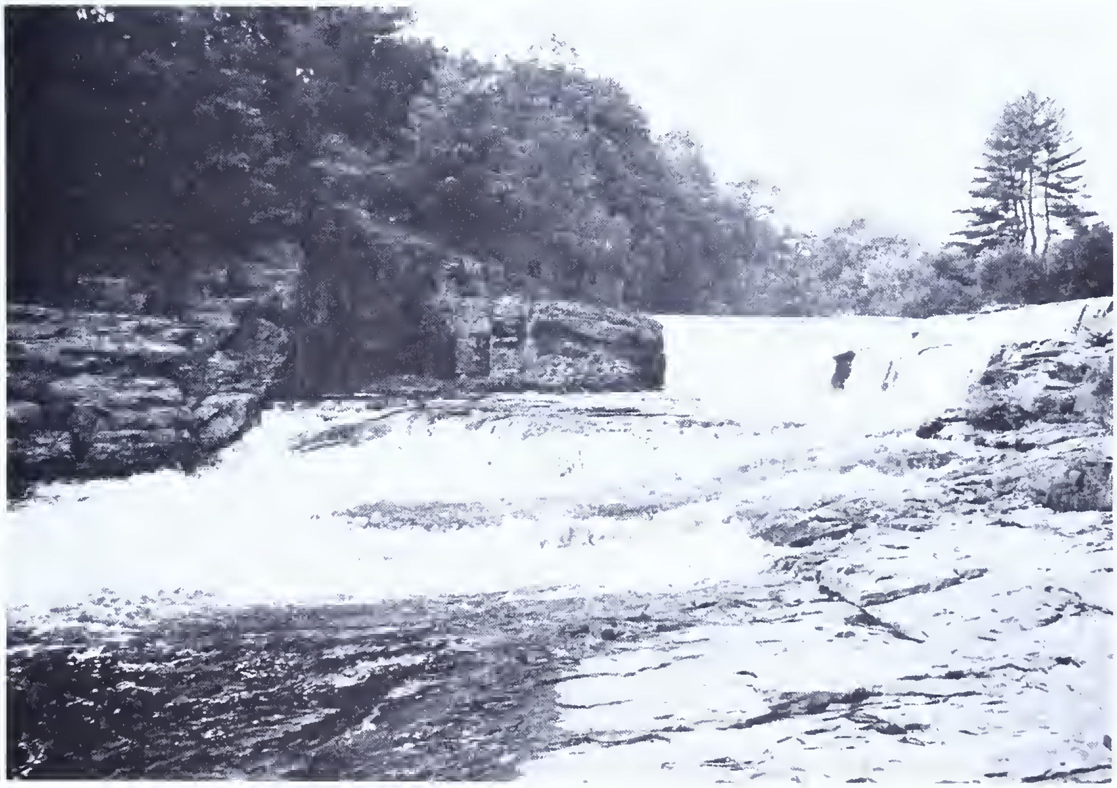
# 445. GREAT FALLS OF THE LEHIGH

COUNTY: Luzerne TOWNSHIP: Buck

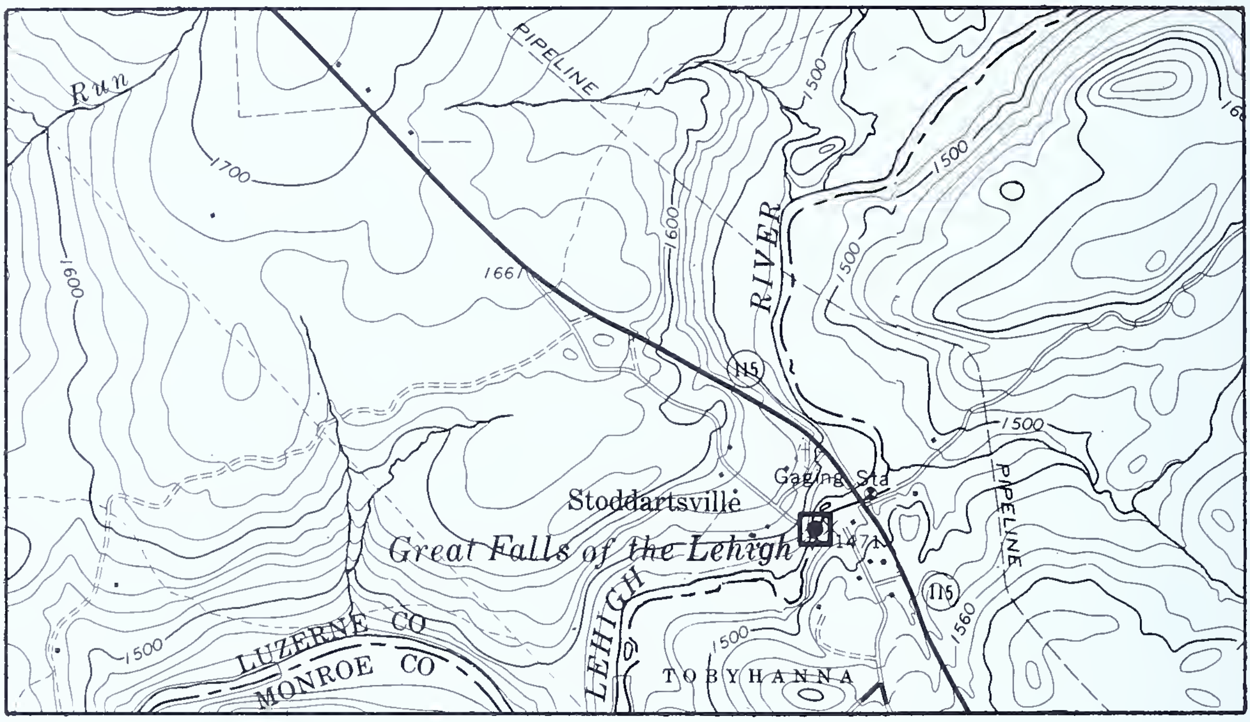
QUADRANGLE: Pleasantview Summit

LOCATION: At the village of Stoddartsville, several hundred feet downstream from the bridge on Pa. Route 115.

REMARKS: The major waterfall on the Lehigh River; flat-lying beds of gray-green sandstone (Catskill Formation, Devonian age) have been cut by the river to form the jagged 25-foot-high falls. A pronounced north-south joint system in the rocks has been a factor in the erosion of the gorge by the river. During high-water stages the color of the water is golden, adding to the great beauty of the site. Adjacent to the falls is the ruins of an old grist mill, reported at one time to be the largest in the state. The site is also known as the **Stoddartsville Falls** and the **Lehigh Falls;** it is partially protected by the Stoddartsville Falls Association.



## 445. GREAT FALLS OF THE LEHIGH *(continued)*



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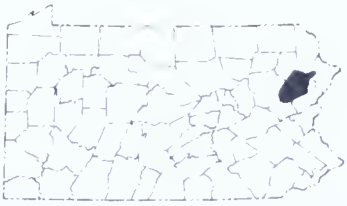


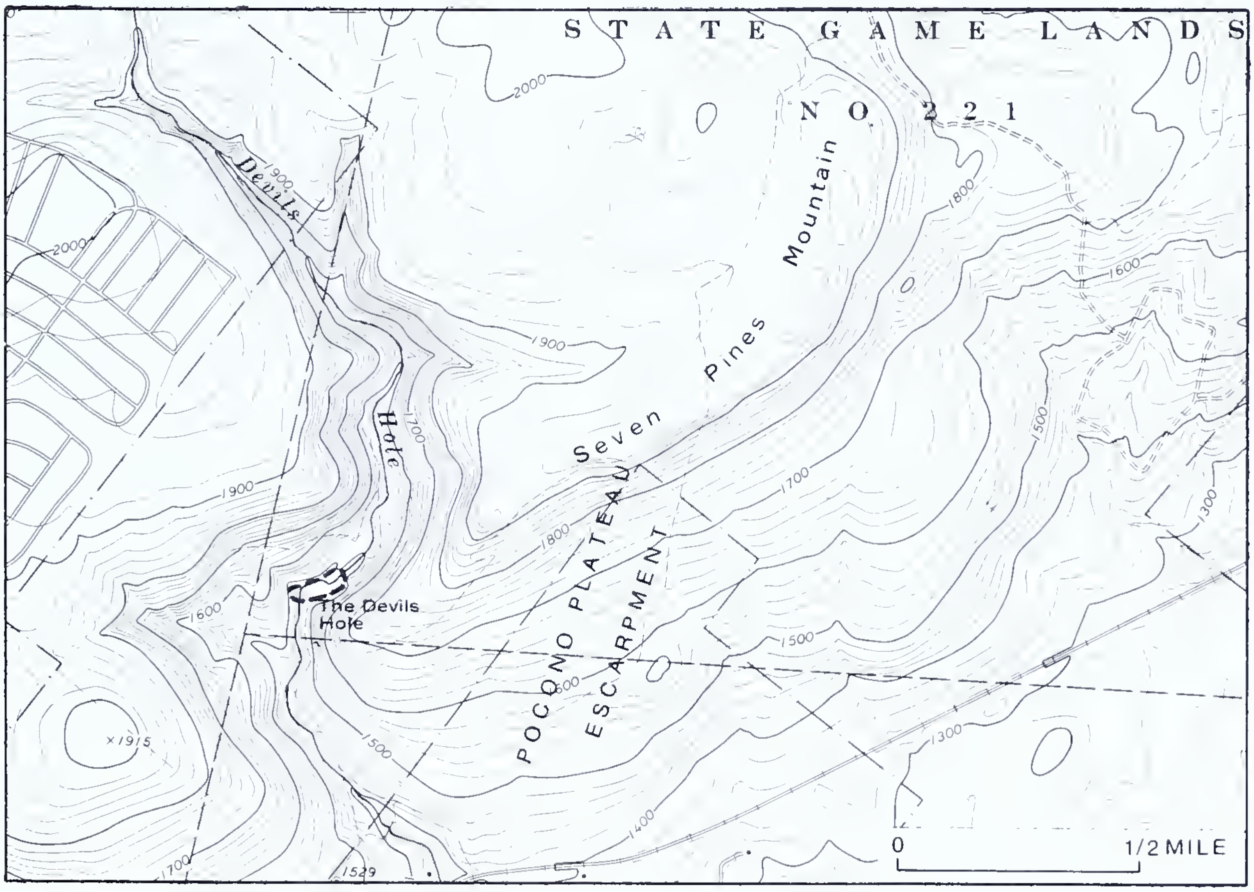
# 446. THE DEVILS HOLE

COUNTY: Monroe TOWNSHIP: Barrett

QUADRANGLE: Buck Hill Falls

LOCATION: Along Devils Hole Creek on State Game Lands No. 221, about 2 miles northeast of Mount Pocono.

REMARKS: A dimly lighted opening in the valley of a highly scenic, steep-walled, forested ravine. The Pocono Plateau escarpment here is a spectacular topographic feature that rises 500 to 600 feet above the low plateau to the southeast. The ravine of Devils Hole Creek, sculptured by glacial scour, dissects the escarpment.



## 446. THE DEVILS HOLE *(continued)*

Nearly vertical cliffs of gray sandstone and grayish-red shale (Catskill Formation, Long Run Member, Devonian age) surround the site and add to its scenic beauty.

REFERENCE: Sevon, W. D. (1975), *Geology and mineral resources of the Tobyhanna and Buck Hill Falls quadrangles, Monroe County, Pennsylvania,* Pennsylvania Geological Survey, 4th ser., Atlas 204ab, scale 1:24,000, 2 sheets.

NOTES:

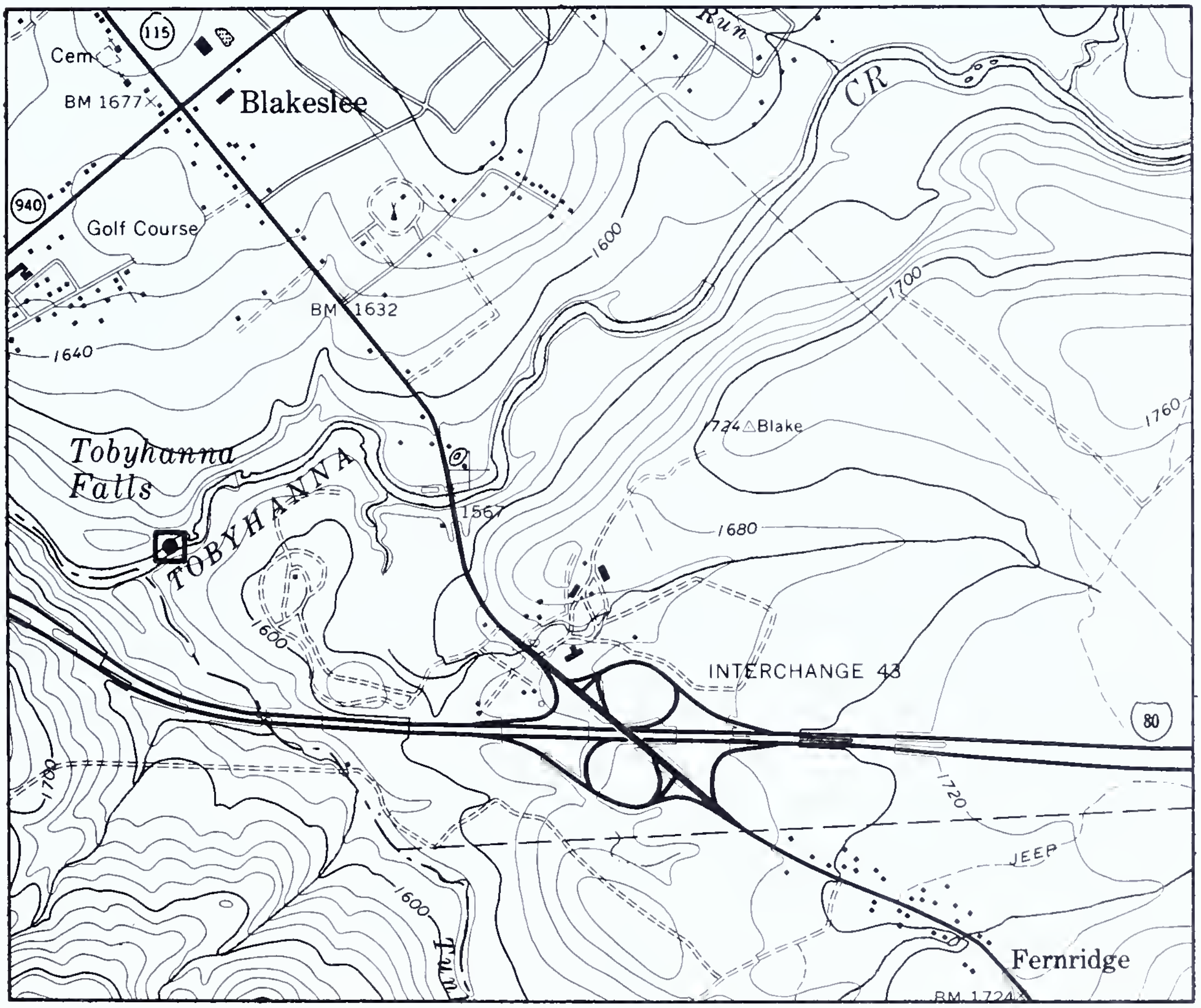
# 447. TOBYHANNA FALLS

COUNTY: Monroe TOWNSHIP: Tobyhanna

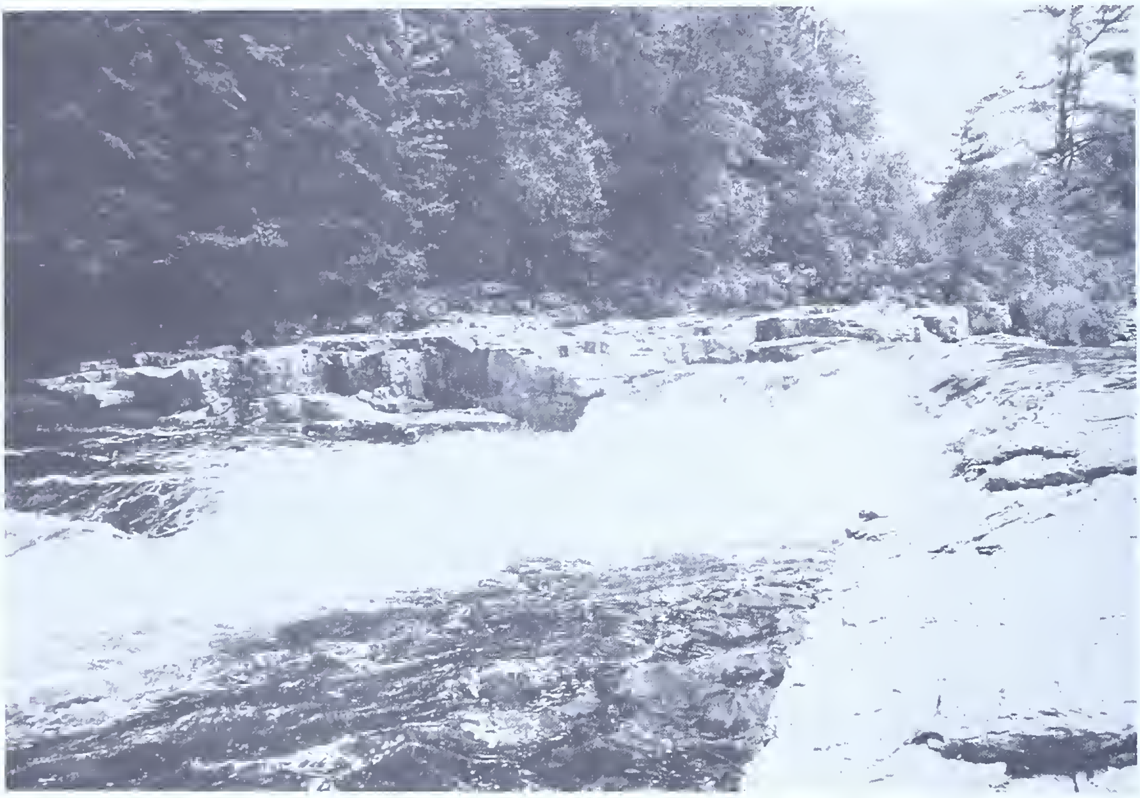
QUADRANGLE: Blakeslee

LOCATION: On Tobyhanna Creek about 0.9 mile northwest of interchange 43 on Interstate Route 80; within the Fern Ridge KOA campgrounds.

REMARKS: A beautiful falls plunges 10 feet over grayish-red sandstone (Catskill Formation, Duncannon Member, Devonian age); golden-colored water flows over the falls during periods of high water, adding to the beauty of the site.



## 447. TOBYHANNA FALLS *(continued)*



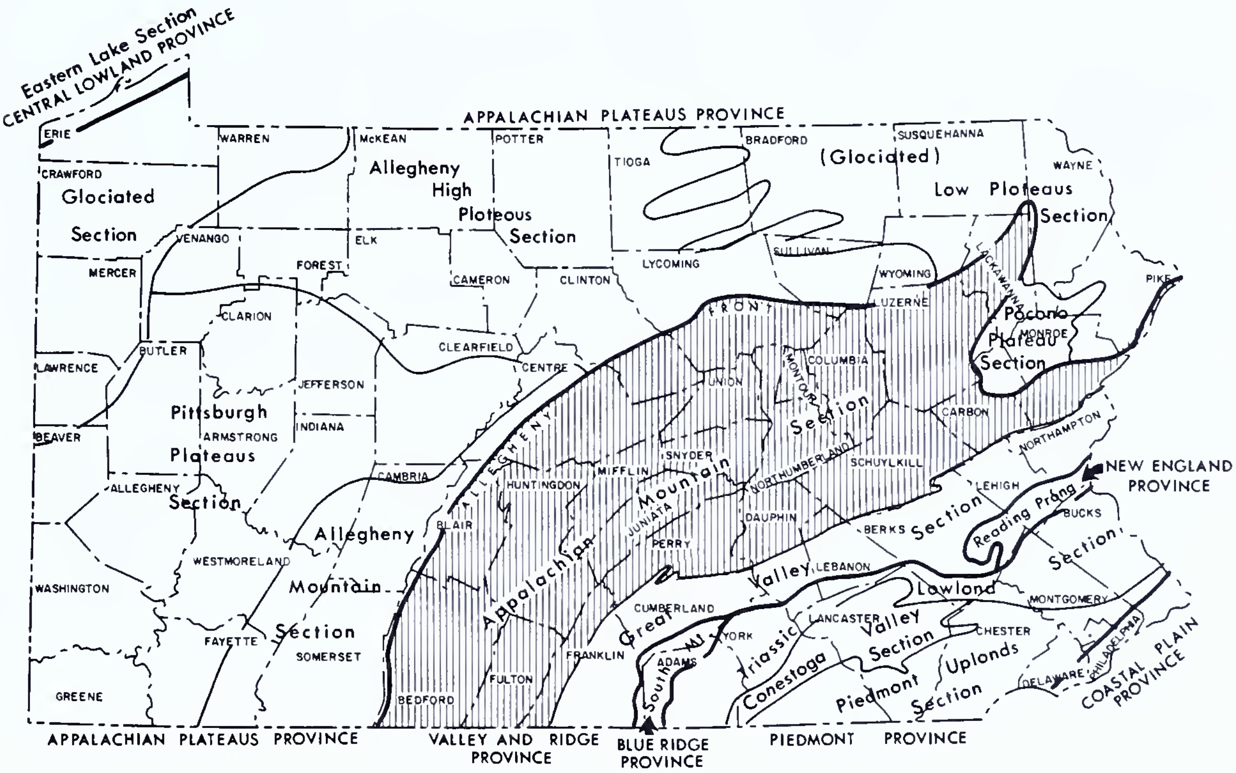
NOTES:

# VALLEY AND RIDGE PROVINCE— APPALACHIAN MOUNTAIN SECTION

## *TOPOGRAPHY*

A series of long, parallel, sharp-crested ridges separated by long, narrow valleys characterize the Appalachian Mountain section. These mountains and valleys form a "backbone" across the center of the state from the southwest to the northeast. The mountain slopes are only slightly dissected and the crest lines are almost uninterrupted and uniform. Limestone and limy shales weather rapidly by solution and underlie the lowest valleys, whereas quartzite and sandstone are more resistant and underlie the higher ridges. The differential weathering characteristics and upright folds have produced this typical topography of long valleys and ridges.

The Susquehanna River flows south through the center, producing magnificent water gaps where the ridges have been sliced by the river. Farther east, the Lehigh River flows south in a steep-sided gorge that cuts across the mountains. In many places the gorge is over 1,000 feet deep. Smaller streams generally flow in the center of the valleys and parallel to the mountain ridges.



Mountaintops range in elevation from 1,400 to 2,800 feet above sea level, increasing in height gradually to the southwest. Valley elevations vary between 200 and 1,500 feet above sea level. The maximum relief occurs in Bedford County about 1 mile east of Hyndman, where the elevation of Wills Mountain is 2,800 feet and the elevation in the adjacent valley to the west is 1,000 feet, resulting in a relief of 1,800 feet. Generally the relief between a ridge and a neighboring valley varies from 800 to 1,000 feet.

## *ROCK COLUMN*

A wide range of rock types exists. A general description of the rock units follows:

| SYSTEM | ROCK UNIT | DESCRIPTION |
|---|---|---|
| Quaternary | Alluvium | Sorted clay to very coarse gravel. |
| Pennsylvanian | Post-Pottsville Formations (includes Llewellyn Formation) | Sandstone, conglomerate, shale, fireclay, slate, and numerous coal beds. |
|  | Pottsville Formation | Hard coarse quartz conglomerate; brown and gray sandstone; a few thin seams of coal. |
| Mississippian | Mauch Chunk Formation | Red shale and brown flaggy sandstone. |
|  | Pocono Formation and Burgoon Sandstone | Hard massive yellowish-gray sandstone; conglomerate, some shale, and some coal. |
| Mississippian and Devonian | Rockwell Formation, Huntley Mountain Formation, and Spechty Kopf Formation | Gray, fine- to coarse-grained sandstone, siltstone, and shale (Rockwell); greenish- and olive-gray sandstone, siltstone, and shale (Huntley Mountain); and light- to olive-gray, fine- to medium-grained, crossbedded sandstone, siltstone, and pebbly mudstone in fining-upward cycles (Spechty Kopf). |
| Devonian | Catskill Formation | Red shale and thin gray sandstone. |
|  | Foreknobs, Scherr, and Lock Haven Formations | Medium- to olive-gray sandstone, siltstone, and shale (Foreknobs); olive- and greenish-gray, fossiliferous siltstone, shale, and sandstone (Scherr); and olive-gray to olive-brown, fossiliferous shale, siltstone, and sandstone and local thin conglomerate (Lock Haven). |

# VALLEY AND RIDGE PROVINCE

## APPALACHIAN MOUNTAIN SECTION

| SYSTEM | ROCK UNIT | DESCRIPTION |
|---|---|---|
| Devonian | Trimmers Rock and Brallier Formations | Olive-gray siltstone and shale; locally, very fine grained sandstone. |
| | Harrell Formation | Light- to olive-gray shale; very dark gray shale at base. |
| | Hamilton Group | |
| | Mahantango Formation | Olive- and medium-gray sandstone, siltstone, and shale; medium-gray limestone and calcareous shale at top. |
| | Marcellus Formation | Black fissile carbonaceous shale; sandstone or shaly limestone locally in lower part. |
| | Onondaga Formation and Buttermilk Falls Limestone | Onondaga: medium-gray calcareous fossiliferous shale; medium-gray clayey limestone at top. Buttermilk Falls Limestone: clayey fossiliferous limestone containing layers of black chert; hard, fossiliferous clay ironstone; gray to black, massive clay shale. |
| | Old Port Formation | Fine- to very coarse grained, light-gray sandstone; dark-gray shale and siltstone; medium- to medium-dark-gray, cherty limestone. |
| Devonian and Silurian | Keyser and Tonoloway Formations | Dark-gray thick-bedded limestone. |
| Silurian | Wills Creek Formation | Greenish-gray thin-bedded shale; local limestone and sandstone; some red shale and red siltstone at bottom. |
| | Bloomsburg and Mifflintown Formations | Red sandstone and prominent red shales; greenish-gray shale containing thin layers of impure limestone. |
| | Clinton Group and Rose Hill Formation | Reddish to greenish-gray, fossiliferous shale; gray fossiliferous limestone; brown sandstone. |
| | Tuscarora and Shawangunk Formations | Gray thick-bedded sandstone and conglomerate. |
| Ordovician | Juniata Formation | Red shale and micaceous sandstone. |
| | Bald Eagle Formation | Thick-bedded sandstone; includes some red shale. |
| | Reedsville and Martinsburg Formations | Dark shale and thin layers of limestone. |

| SYSTEM | ROCK UNIT | DESCRIPTION |
|---|---|---|
| Ordovician | Coburn Formation,<br>Salona Formation, and<br>Nealmont Formation | Dark-gray thin-bedded limestone; in part fossiliferous. |
| | Benner Formation,<br>Valentine Member,<br>Snyder Formation,<br>Hatter Formation, and<br>Loysburg Formation | Gray impure limestone (the Valentine is a high-calcium limestone). |
| | Beekmantown Group | |
| | Bellefonte Formation | Gray medium-bedded dense dolomite. |
| | Axemann Formation | Bluish-gray medium-bedded impure limestone. |
| | Nittany Formation | Light-gray thick-layered dolomite. |
| | Stonehenge and Larke Formations | Thick-bedded dark-gray dolomite and thin sandstone layers. |
| Cambrian | Gatesburg Formation | Bluish-gray dolomite containing sandstone interbeds. |
| | Mines Member | Bluish-gray dolomite; oolitic chert. |
| | Warrior Formation | Dark-gray limestone beds separated by shaly partings. |
| | Pleasant Hill Formation | Dark-gray thick-bedded limestone and thin-bedded shaly limestone. |

## *ROCK STRUCTURE*

Major folds extend the length of the section from south-central to northeastern Pennsylvania and are the dominant structures. Numerous smaller folds occur within the major folds, and even smaller folds can be found in individual outcrops. Faults make up a lesser part of the structure, and for the most part they are reverse faults that duplicate the rock sequence and produce lateral shortening and vertical extension of the folds. Fractures are common and tend to control the location of many tributary streams. The water and wind gaps are also probably due to erosion along zones of more intense fracturing of the rock layers.

# 448. BENNER SPRING (ROCK SPRING)

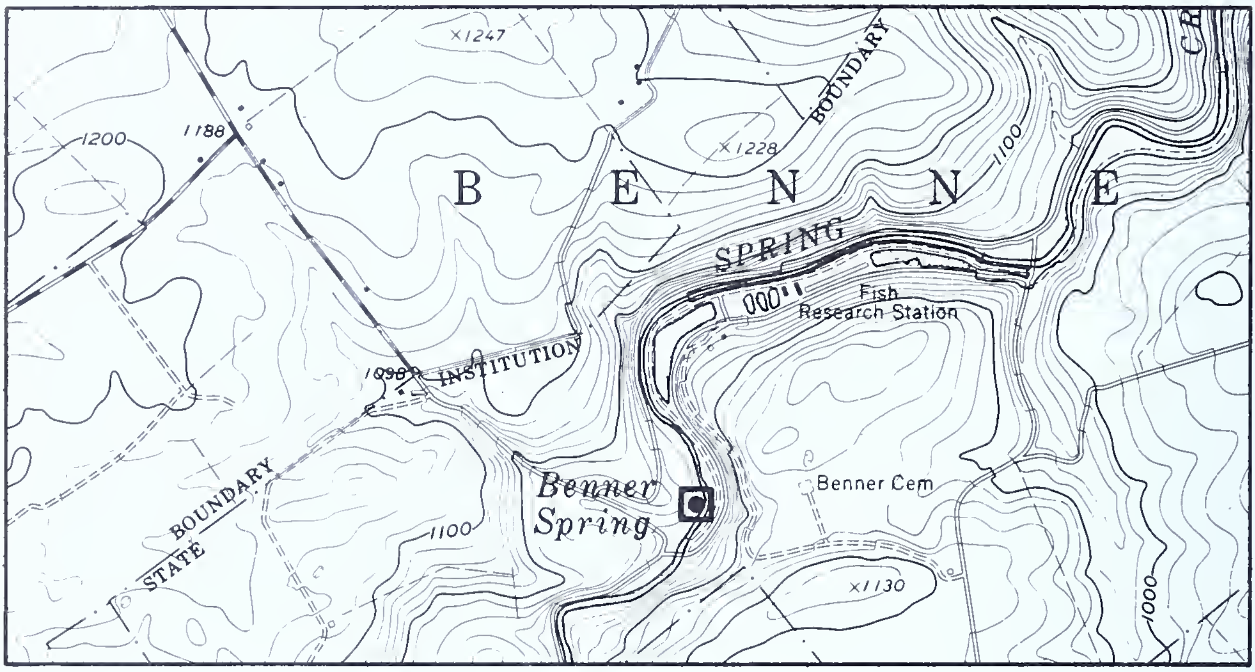
COUNTY: Centre TOWNSHIP: Benner

QUADRANGLE: State College

LOCATION: Along Spring Creek, 0.5 mile south of the Benner Fish Culture Station of the Pennsylvania Fish Commission; within the Rockview State Correctional Institution boundary.

REMARKS: The spring is near or at the contact of dolomite of the Mines Member (Gatesburg Formation, Cambrian age) and the limestone/dolomite of the Stonehenge Formation (Ordovician age). This spring is of second-order magnitude; the measured yield ranges from a low of 3,500 gallons per minute to over 10,000 gallons per minute. The Pennsylvania Fish Commission normally uses 7,000 to 10,000 gallons per minute, and the Rockview Penitentiary facility uses about 700 gallons per minute.

## 448. BENNER SPRING (ROCK SPRING) *(continued)*



CHEMISTRY: Temperature, 10.0°C; Ca, 46 mg/L (milligrams per liter); $HCO_3$, 120 mg/L; $CaCO_3$, 165 mg/L (hard water); pH, 7.0.

REFERENCES: Flippo, H. N., Jr. (1974), *Springs of Pennsylvania,* Pennsylvania Department of Environmental Resources, Office of Resources Management, Water Resources Bulletin 10, 46 p.

Truesdale, David (1983), personal communication, Pennsylvania Fish Commission, Benner Fish Culture Station.

NOTES:

# 449. BIG SPRING

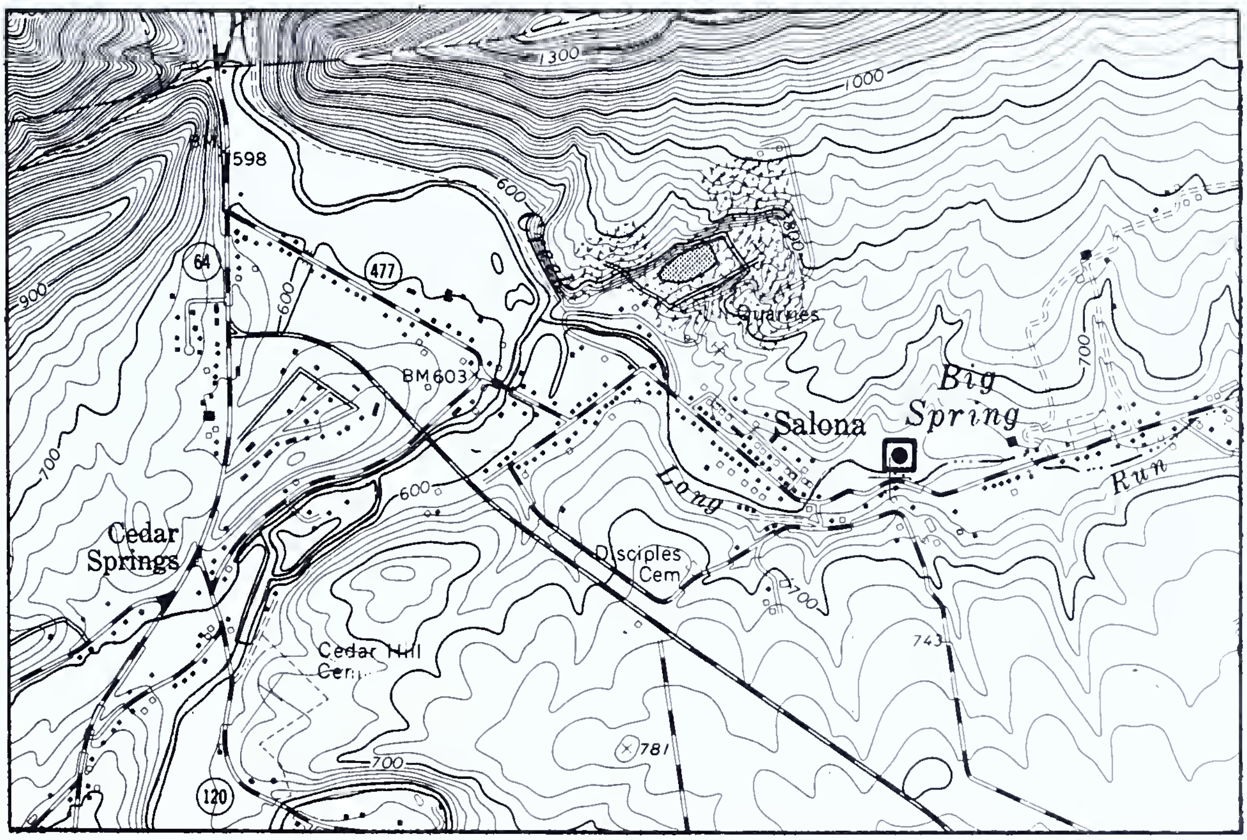
COUNTY: Clinton TOWNSHIP: Lamar

QUADRANGLE: Mill Hall

LOCATION: About 0.2 mile east of the village of Salona, along Long Run.

REMARKS: This highly scenic spring, located in a grove of large hemlock trees, issues from solution openings in horizontal layers of dolomite in the Bellefonte Formation (Ordovician age). The estimated yield (May 1984) is in excess of 5,000 gallons per minute. The spring is used in part for a small, private fish hatchery (Cedar Springs Trout Hatchery, Salona Station).

REFERENCE: Flippo, H. N., Jr. (1974), *Springs of Pennsylvania,* Pennsylvania Department of Environmental Resources, Office of Resources Management, Water Resources Bulletin 10, 46 p.



## 449. BIG SPRING *(continued)*

# 450. BIRMINGHAM FAULT

COUNTY: Blair TOWNSHIP: Tyrone

QUADRANGLE: Tyrone

LOCATION: Along the Conrail tracks southwest of the borough of Birmingham, on the west side of the Little Juniata River, 2.5 miles southeast of Tyrone.

REMARKS: The sandy dolomite of the Gatesburg Formation (Cambrian age) overlies Ordovician limestone. The overthrust fault is the contact between the two formations. The fault dips about 5 degrees to the south. This site and one nearby (**Birmingham Window,** site 451), on the hinge of the Nittany Arch, are the only surface exposures that show the repetition of rock units by overthrusting in the Valley and Ridge province. This exposure is an important clue to the décollement tectonics that produced the folded Appalachians.

REFERENCES:

Butts, Charles (1918), *Geologic section of Blair and Huntingdon Counties, central Pennsylvania,* American Journal of Science, 4th ser., v. 46, p. 523–537.

Butts, Charles, Swartz, F. M., and Willard, Bradford (1939), *Tyrone quadrangle—Geology and mineral resources,* Pennsylvania Geological Survey, 4th ser., Atlas 96, 118 p.

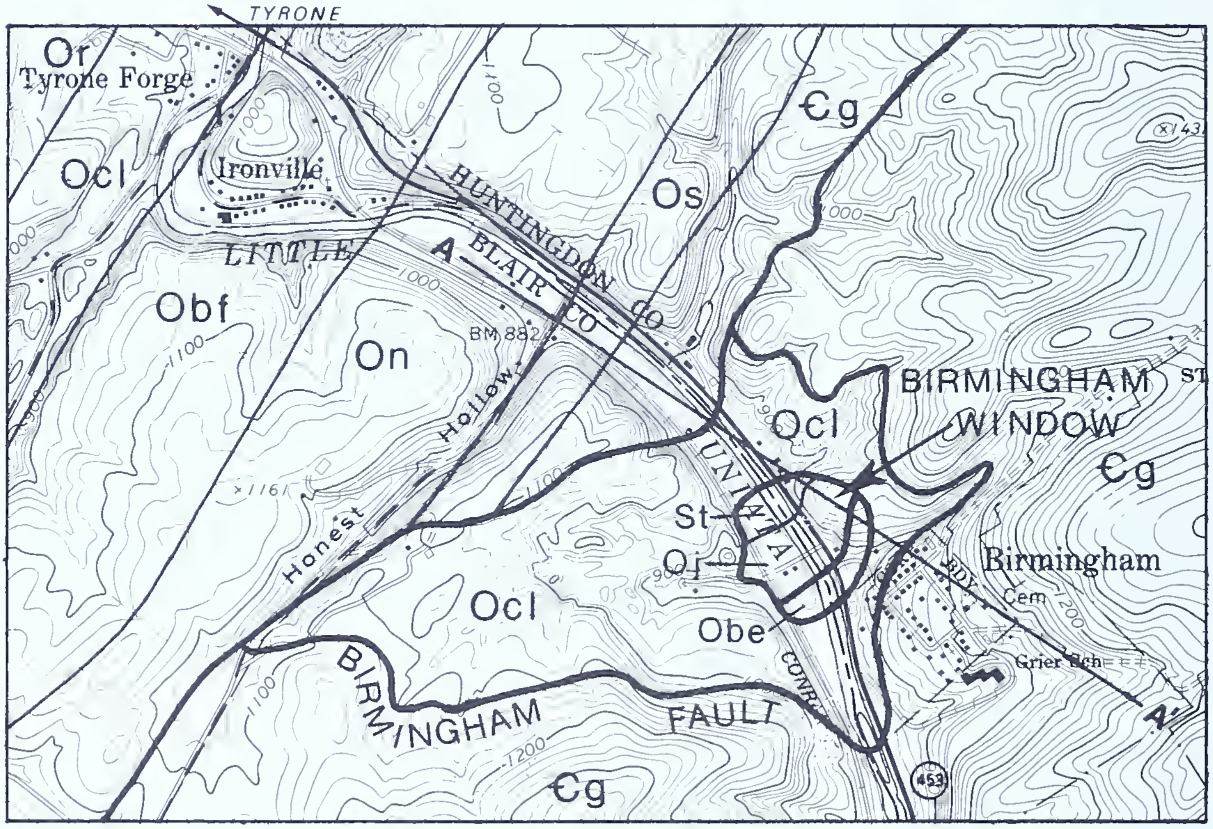
Faill, R. T. (in preparation), *The Birmingham Window—Alleghanian décollement tectonics in the Cambrian-Ordovician succession of the Appalachian Valley and Ridge province, Birmingham, Pennsylvania,* Geological Society of America, Decade of North American Geology.

Gwinn, V. E. (1970), *Kinematic patterns and estimates of lateral shortening, Valley and Ridge and Great Valley, central Appalachians, south-central Pennsylvania,* in Fisher, G. W., and others, eds., *Studies of Appalachian geology: central and*

## 450. BIRMINGHAM FAULT *(continued)*

*southern,* New York, Interscience Publishers, p. 127–146.

Moebs, N. N., and Hoy, R. B. (1959), *Thrust faulting in Sinking Valley, Blair and Huntingdon Counties, Pennsylvania,* Geological Society of America Bulletin, v. 70, p. 1079–1088.



GEOLOGIC MAP
(from Faill, R. T., unpublished map)

### EXPLANATION

| | | | | |
|---|---|---|---|---|
| | St | Tuscarora Formation | Obf | Bellefonte Formation |
| | Oj | Juniata Formation | On | Nittany Formation |
| | Obe | Bald Eagle Formation | Os | Stonehenge Formation |
| Ora | Or | Reedsville Formation | Cg | Gatesburg Formation |
| Ora | Oa | Antes Shale | Cw | Warrior Formation |
| | Ocl | Coburn Formation through Loysburg Formation, undivided | | |

——— Geologic contact

━━━ Fault

A———A′ Line of geologic cross section
(see page 113 for cross section)

# 451. BIRMINGHAM WINDOW

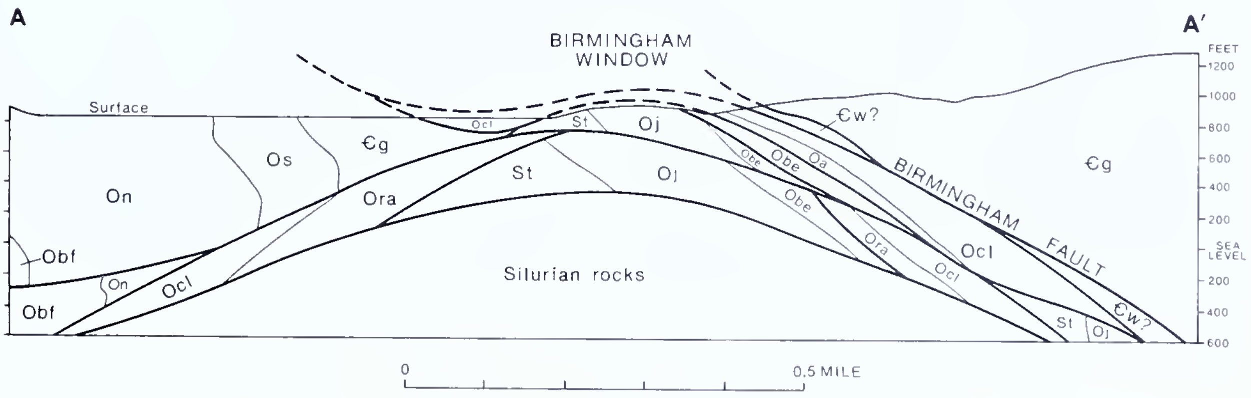
COUNTY: Huntingdon TOWNSHIP: Warriors Mark

QUADRANGLE: Tyrone

LOCATION: Along Pa. Route 453, near the north corner of the borough of Birmingham, 2.5 miles southeast of Tyrone (see location map on previous page).

REMARKS: The sandstone of the Tuscarora Formation (Silurian age) and the shale and siltstone of the Juniata Formation (Ordovician age) are exposed along the road (Pa. Route 453). On the hillside above are "float" fragments of Ordovician limestone, and above that are sandy dolomite fragments of the Gatesburg Formation (Cambrian age). To the south is "altered" black shale (Antes Formation, Ordovician age), very close to the overthrust.

REFERENCES: See references for Birmingham Fault (site 450), p. 111-112.



CROSS SECTION
(from Faill, R. T., in preparation)

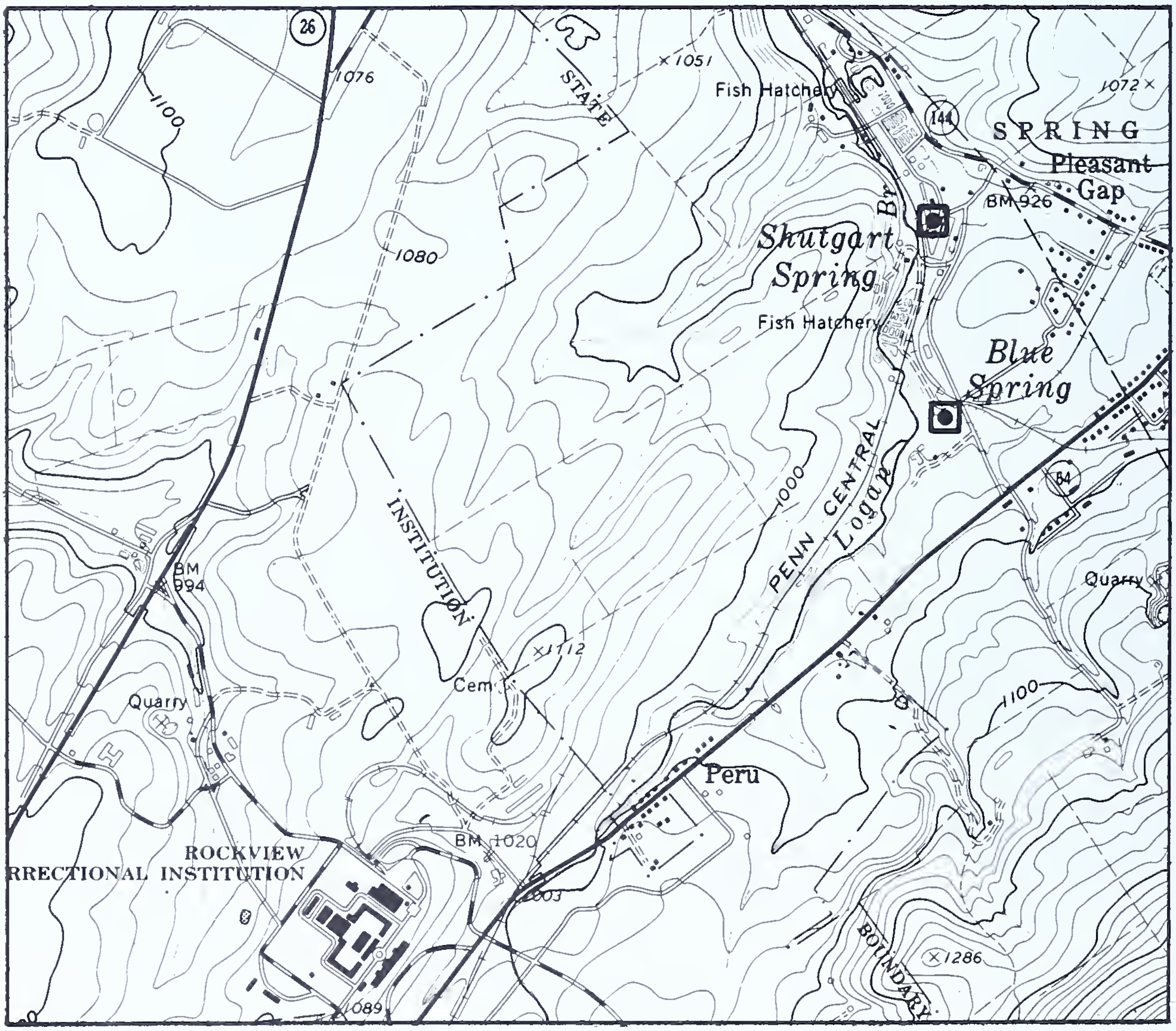
## 452. BLUE SPRING

COUNTY: Centre TOWNSHIP: Benner

QUADRANGLE: State College

LOCATION: Along Logan Branch Creek, about 0.4 mile southeast of Pleasant Gap.

REMARKS: The aquifer is the Benner Formation (mostly limestone, Ordovician age); the measured yield was 2,270 gallons per minute (November 9, 1971). The spring is privately owned and is used by the Pennsylvania Fish Commission for the Pleasant Gap Fish



Culture Station on Logan Branch Creek. The origin of the spring may be fault related.

**Shutgart Spring** (453), located within the Pleasant Gap Fish Culture Station, is owned by the Fish Commission; the aquifer is the Bellefonte Formation (mostly dolomite, Ordovician age).

CHEMISTRY: Temperature, 10.0°C; Ca, 39 mg/L (milligrams per liter); $HCO_3$, 199 mg/L; $CaCO_3$, 113 mg/L (moderately hard); pH, 7.7; highly polluted (November 9, 1971).

REFERENCE: Flippo, H. N., Jr. (1974), *Springs of Pennsylvania,* Pennsylvania Department of Environmental Resources, Office of Resources Management, Water Resources Bulletin 10, 46 p.

BLUE SPRING

## 454. CHALYBEATE SPRING

COUNTY: Bedford TOWNSHIP: Bedford

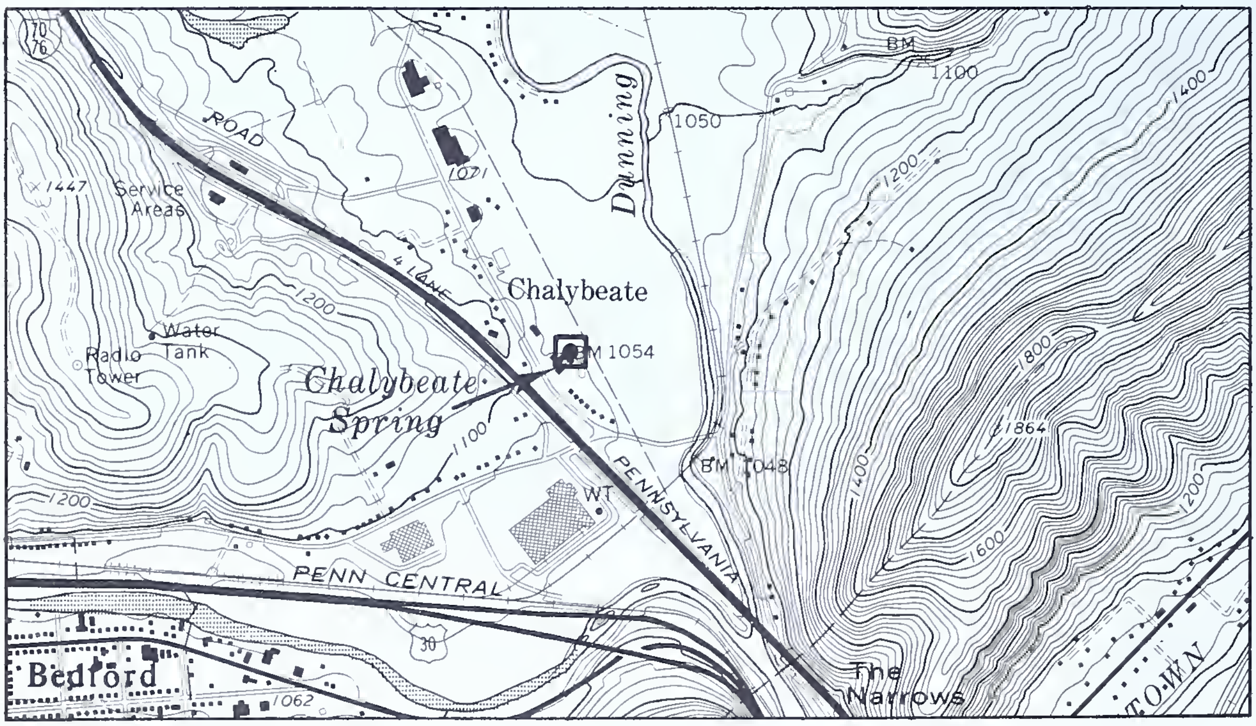
QUADRANGLE: Everett West

LOCATION: One mile northeast of the borough of Bedford, in the village of Chalybeate.

REMARKS: The spring issues from limestone solution openings in the Keyser and Tonoloway Formations (Devonian and Silurian age); the estimated yield (April 1984) is 50 gallons per minute. The spring was one of Pennsylvania's celebrated mineral springs in 1881, supplying water to the resort on whose ground it is located and to the nearby Chalybeate Hotel.

CHEMISTRY: The following analysis was reported by Stevenson (1882): Ca, 4.4 grains; $CaCO_3$, 11.3 grains; $MgCO_3$, 2.5 grains; $FeCO_3$, 0.36 grain.

REFERENCE: Stevenson, J. J. (1882), *The geology of Bedford and Fulton Counties,* Pennsylvania Geological Survey, 2nd ser., Report T2, p. 343.



# VALLEY AND RIDGE PROVINCE

## APPALACHIAN MOUNTAIN SECTION

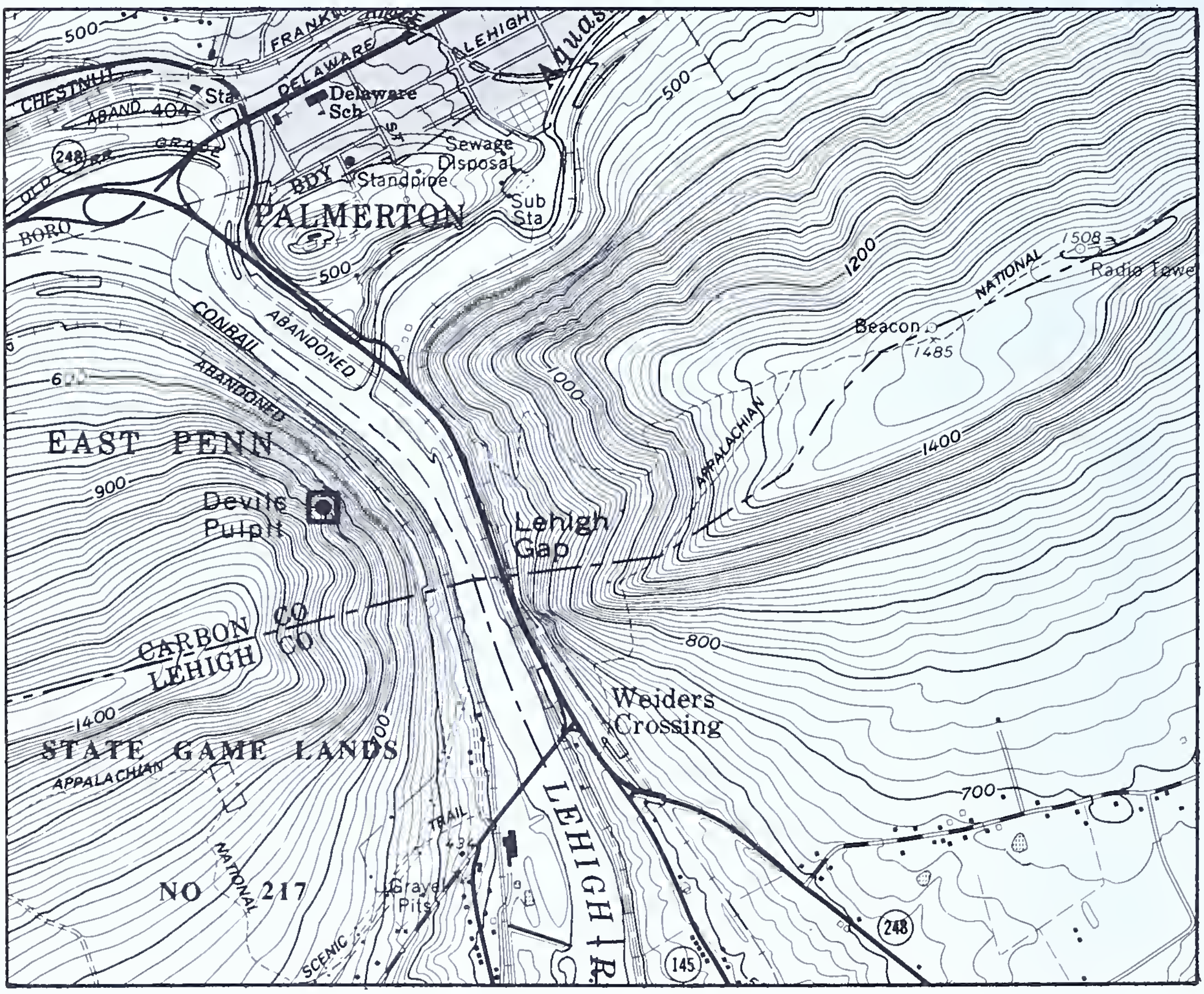
## 455. DEVILS PULPIT

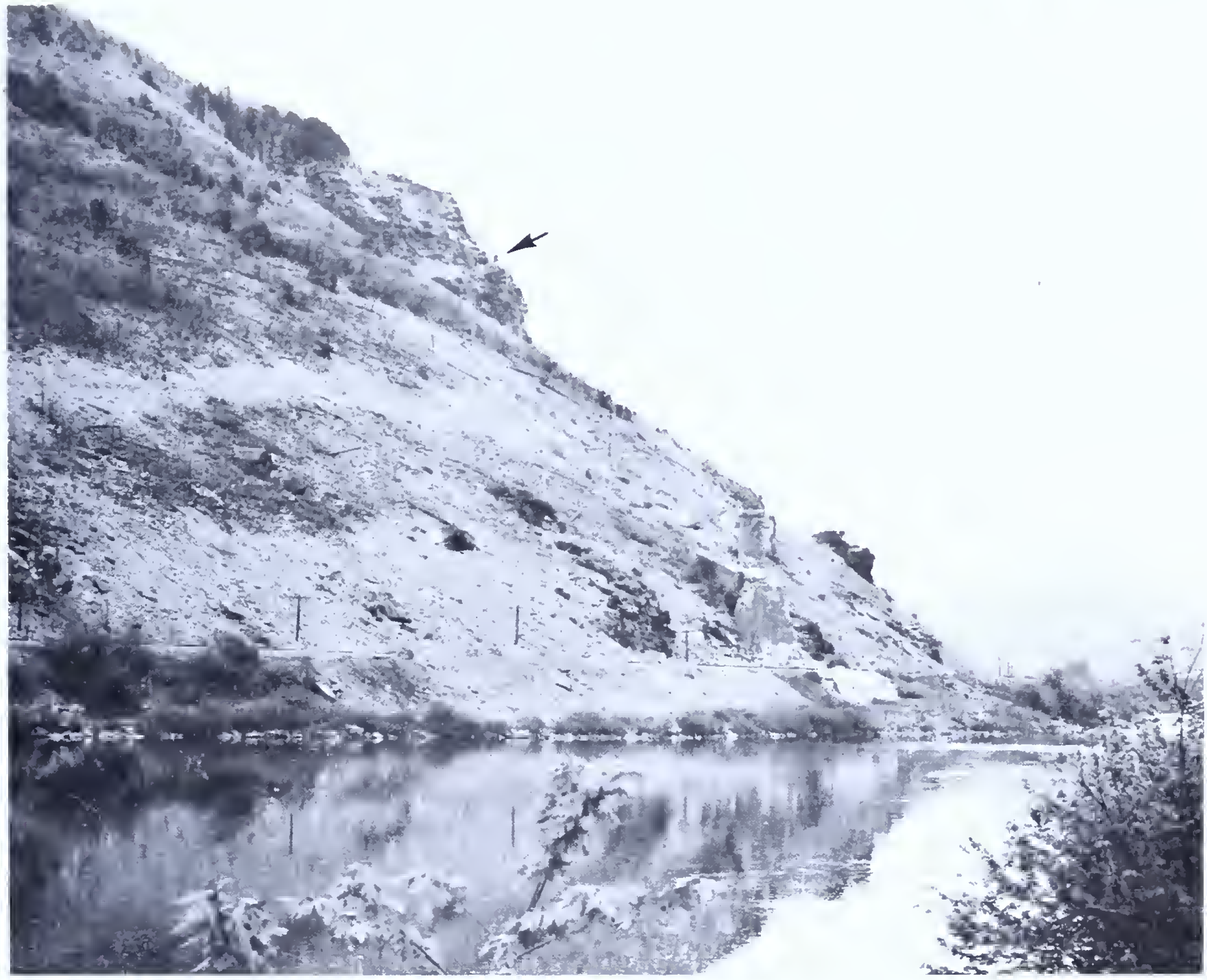
COUNTY: Carbon TOWNSHIP: East Penn

QUADRANGLE: Palmerton

LOCATION: About halfway up the northwest slope of the Lehigh Gap, approximately 0.5 mile southwest of the borough of Palmerton.

REMARKS: Within the Lehigh Gap there is a pinnacle of quartzite (Tuscarora Formation, Silurian age) that resembles a pulpit. Over a hundred years ago this geologic feature was named the "Devil's Pulpit" or "Die Teufel's Kanzel" by local residents. The quartzite pinnacle is a solitary remnant of rock left by erosion of the gap.





(Photograph by J. P. Wilshusen)

REFERENCE: Miller, B. L., Fraser, D. M., Miller, R. L., and others (1941), *Lehigh County, Pennsylvania,* Pennsylvania Geological Survey, 4th ser., County Report 39, p. 70, 127, 135.

NOTES:

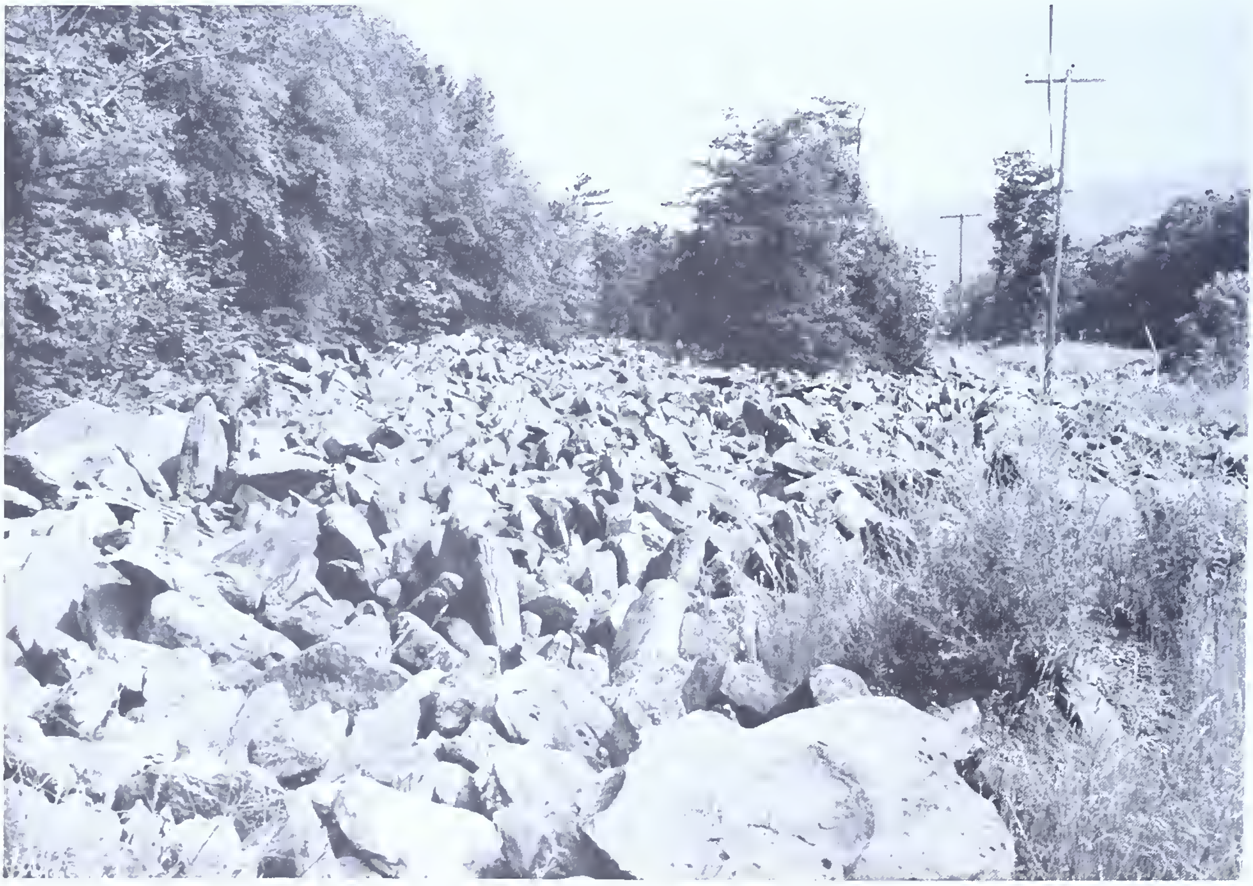
# 456. DEVILS TURNIP PATCH

COUNTY: Lycoming TOWNSHIP: Armstrong

QUADRANGLE: Montoursville South

LOCATION: Adjacent to U.S. Route 15, approximately 3 miles south of Williamsport, within the Tiadaghton State Forest.

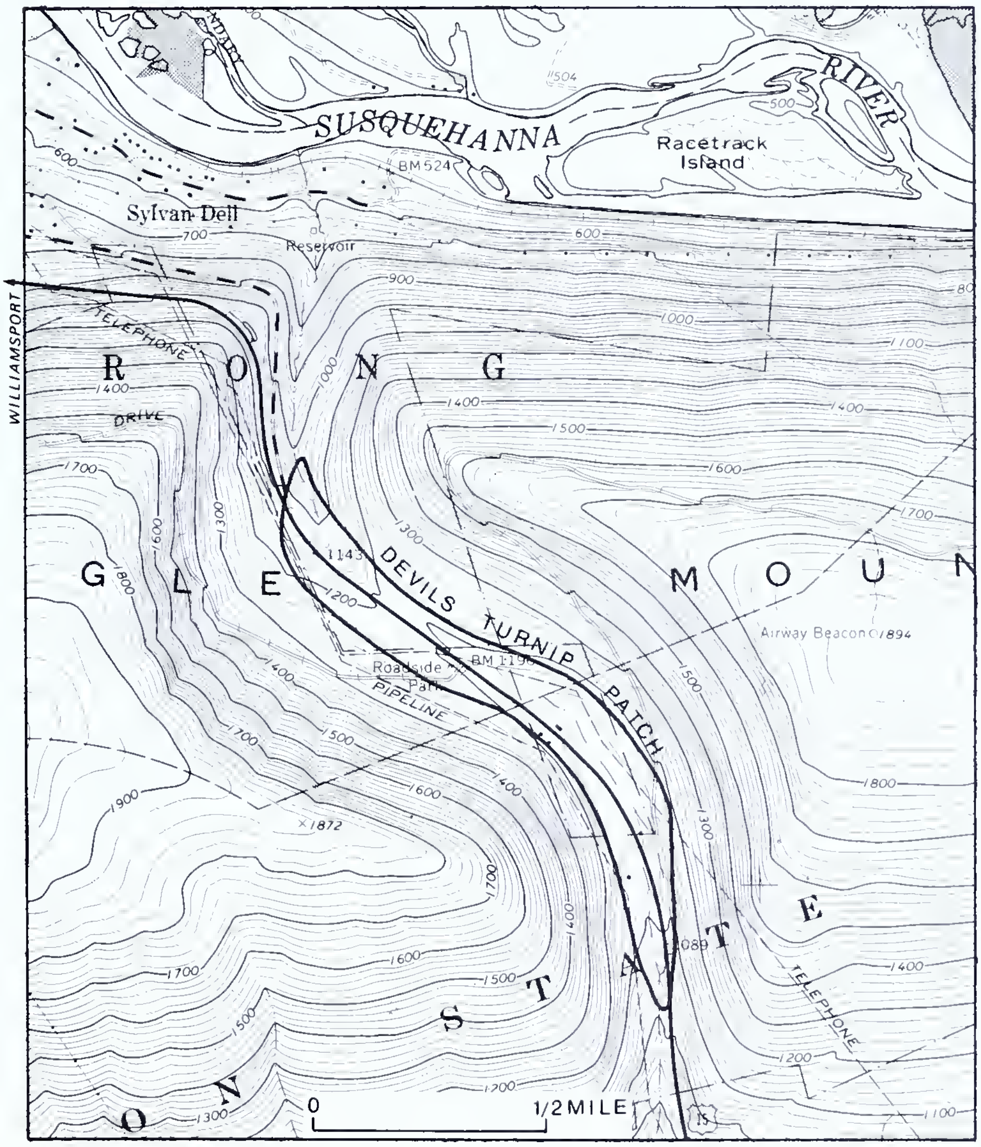
REMARKS: The Devils Turnip Patch is a "boulder field" of quartzite (Tuscarora Formation, Silurian age). Where it is exposed south of the roadside park it is composed of predominantly boulders and cobbles of quartzite, with very little finer material between the large fragments. The boulder field, which is approximately 7 to 50 feet thick, occupies the valley floor in the water gap in Bald Eagle Mountain; the surface is very rough and fairly flat. It is one of the finest examples of a boulder field in Pennsylvania.



The feature was so named by colonial settlers for the purplish color of the rocks.

REFERENCES: Faill, R. T. (1979), *Geology and mineral resources of the Montoursville South and Muncy quadrangles and part of the Hughesville quadrangle, Lycoming, Northumberland, and Montour Counties, Pennsylvania,* Pennsylvania Geological Survey, 4th ser., Atlas 144ab, 114 p.

Kennedy, F. X. (1980), Personal communication, Pennsylvania Department of Environmental Resources, Bureau of Forestry.



## 457. FLAT ROCK

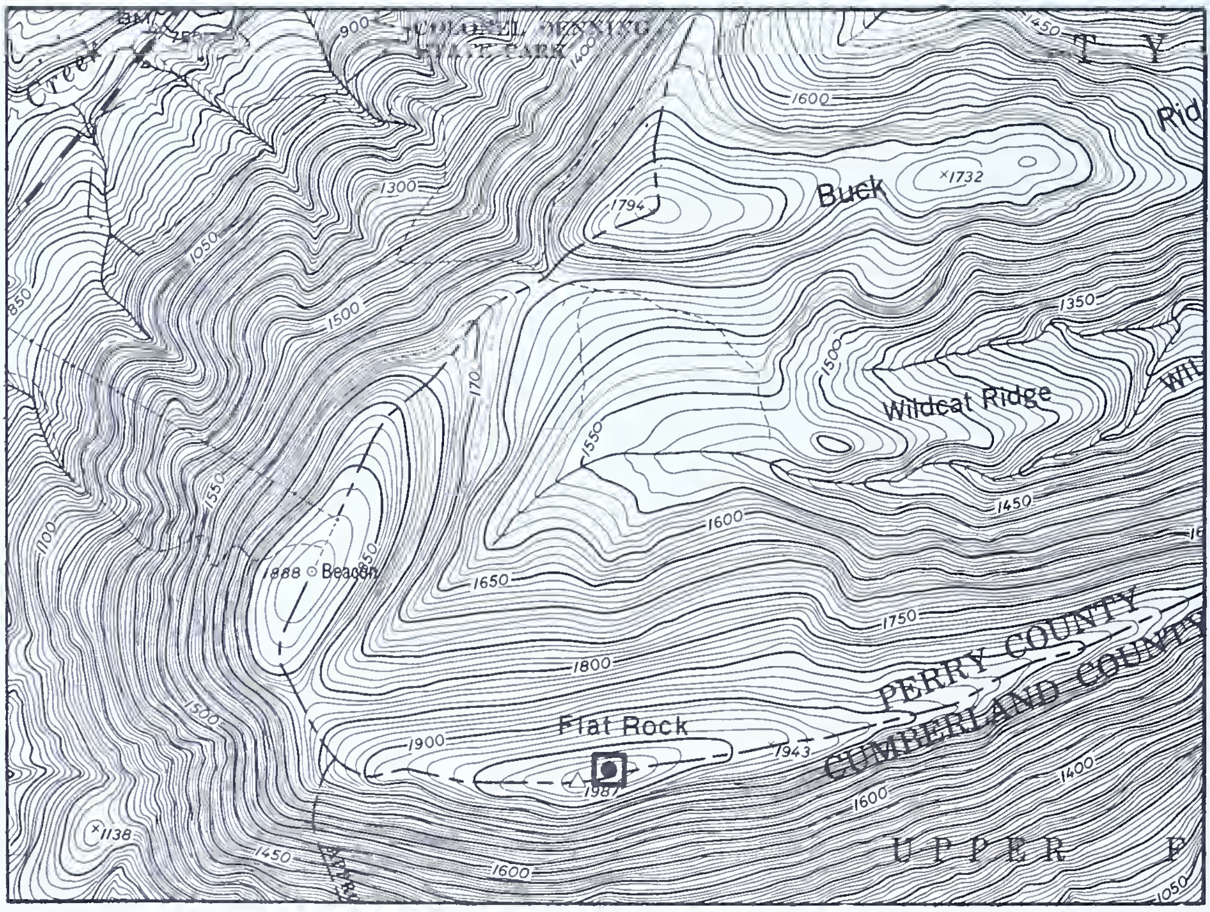
COUNTY: Perry TOWNSHIP: Tyrone

QUADRANGLE: Andersonburg

LOCATION: On the crest of Blue Mountain within Tuscarora State Forest, approximately 2.5 miles south of Colonel Denning State Park on Flat Rock Trail.

REMARKS: Almost flat (dipping 7°N) slabs of quartzite (Tuscarora Formation, Silurian age) form the crest of Blue Mountain, hence the name Flat Rock. A beautiful scenic vista of the Cumberland Valley may be seen as one rests on the rock.

REFERENCE: Miller, J. T. (1961), *Geology and mineral resources of the Loysville quadrangle, Pennsylvania,* Pennsylvania Geological Survey, 4th ser., Atlas 127, 47 p.



# 458. GIRTYS NOTCH

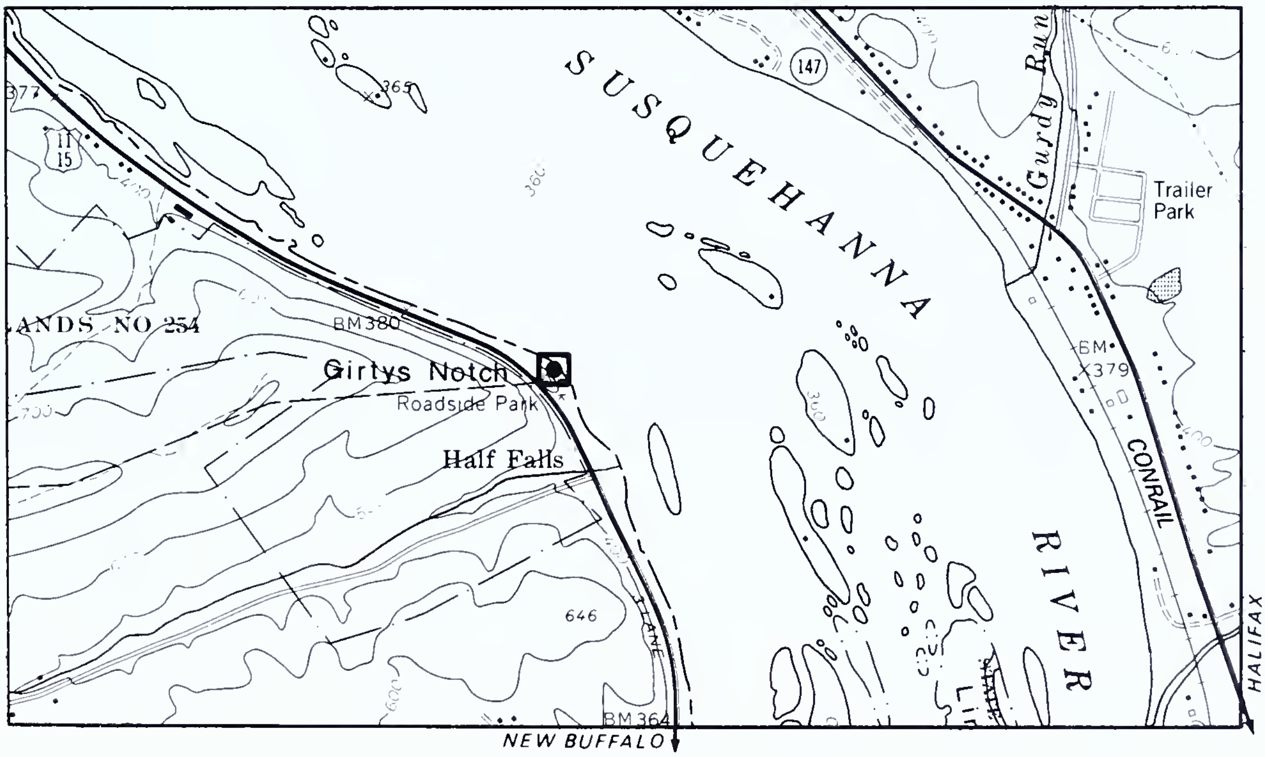
COUNTY: Perry TOWNSHIP: Watts

QUADRANGLE: Halifax

LOCATION: A Pennsylvania Department of Transportation roadside park along U.S. Route 15-11, 3 miles north of New Buffalo, along the west side of the Susquehanna River.

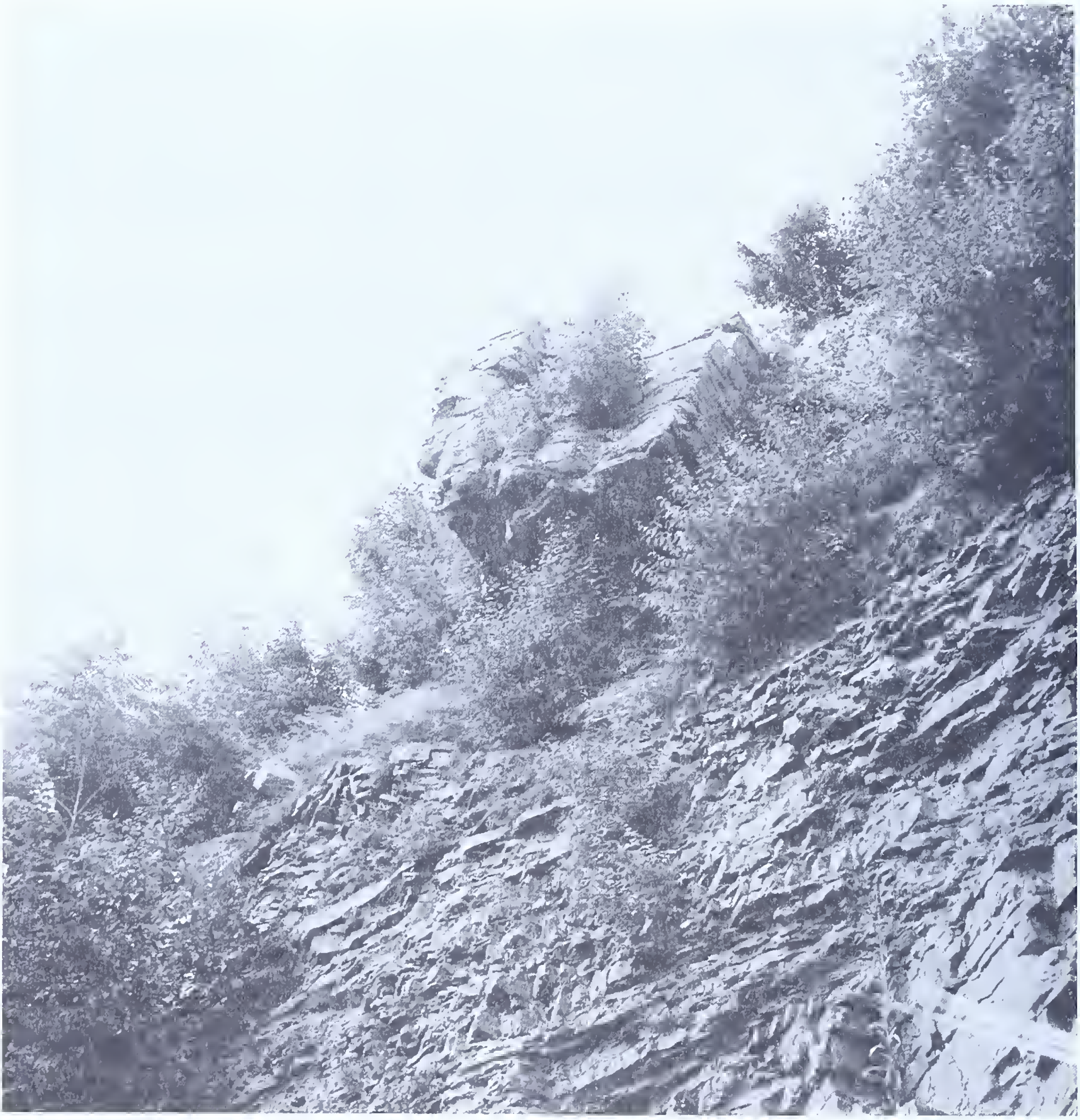
REMARKS: Simon Girty, born near Halifax, Dauphin County, was taken captive and adopted by the Senecas. He grew up to be an Indian in all respects but color. For his actions, true or false, against the white man, historians have labeled him a traitor and the "nastiest character ever to come out of Pennsylvania."

Siltstones and sandstones of the Mahantango Formation (Devonian age) have eroded into a profile of his likeness at this site.



## 458. GIRTYS NOTCH *(continued)*

REFERENCE: Reynolds, P. M. (1978), *Strange but true—Pennsylvania profiles,* v. 2, The Red Rose Studio, Willow Street, Pa., unpaginated.



(Photograph by D. W. Royer)

## 459. GLADE PIKE VISTAS

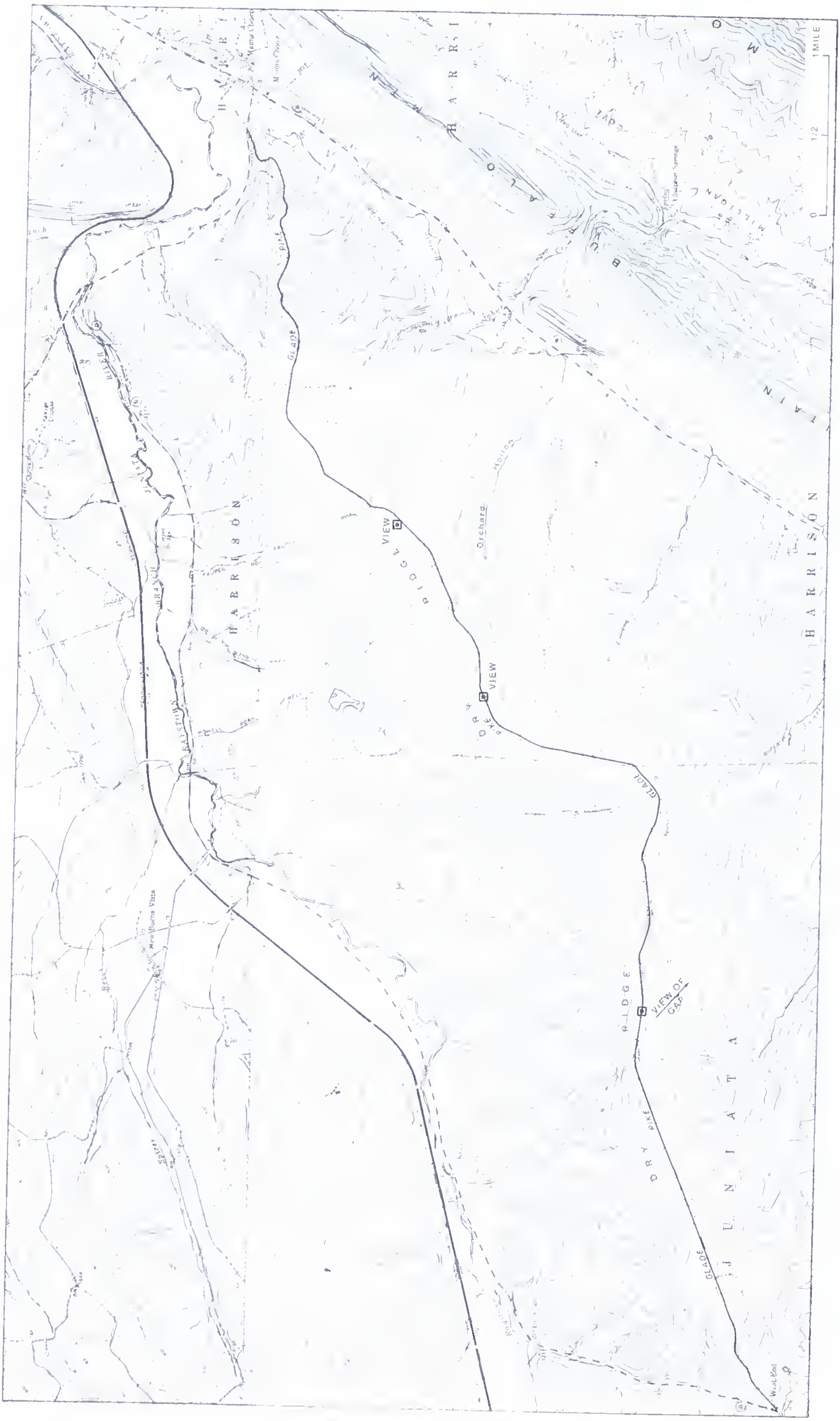
COUNTY: Bedford TOWNSHIPS: Juniata and Harrison

QUADRANGLES: Buffalo Mills, Bedford, and Rainsburg

LOCATION: Glade Pike along Dry Ridge between Manns Choice and West End.

REMARKS: Glade Pike has been called **Pennsylvania's Skyline Drive**. The road follows the sharp crest of Dry Ridge, and there are breathtaking views in all directions. The drive west from West End toward Manns Choice provides the best and the most widely sweeping views facing the traveler.

## 459. GLADE PIKE VISTAS *(continued)*



# 460. HAWK ROCK

COUNTY: Perry TOWNSHIP: Penn

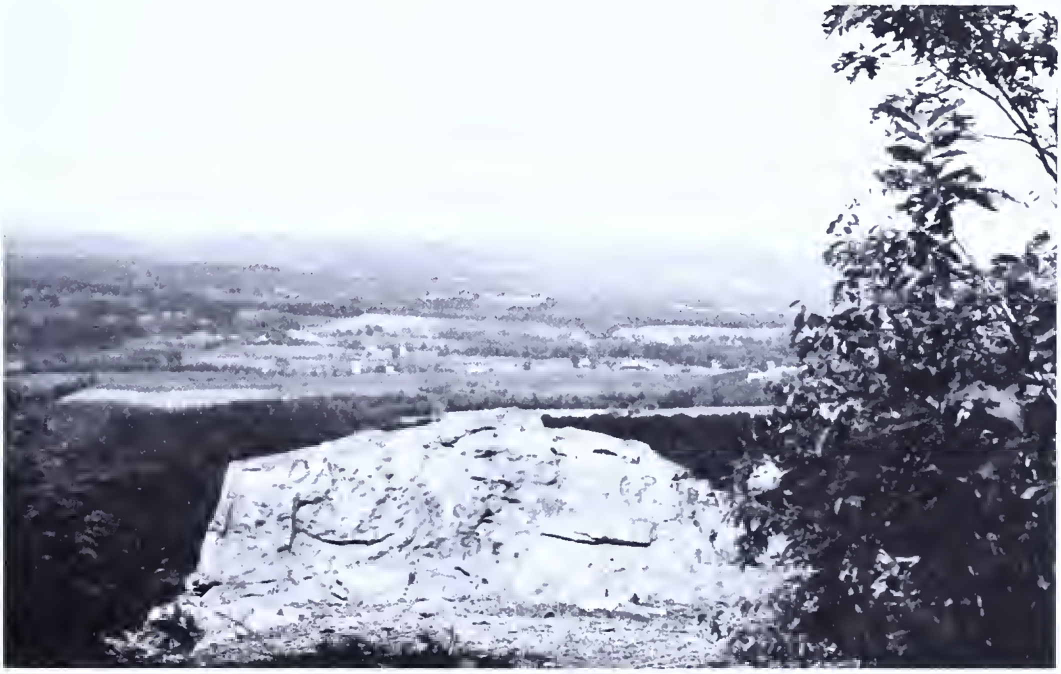
QUADRANGLE: Duncannon

LOCATION: Approximately 0.9 mile south of the borough of Duncannon, near the crest of Cove Mountain on the Appalachian Trail.

REMARKS: Hawk Rock, a ledge of sandstone (Catskill Formation, Devonian age), derives its name from the excellent vantage point to observe hawk migrations. Here, where the reddish-brown sandstone dips steeply to the south, is a breathtaking view of the valley and ridges to the north.

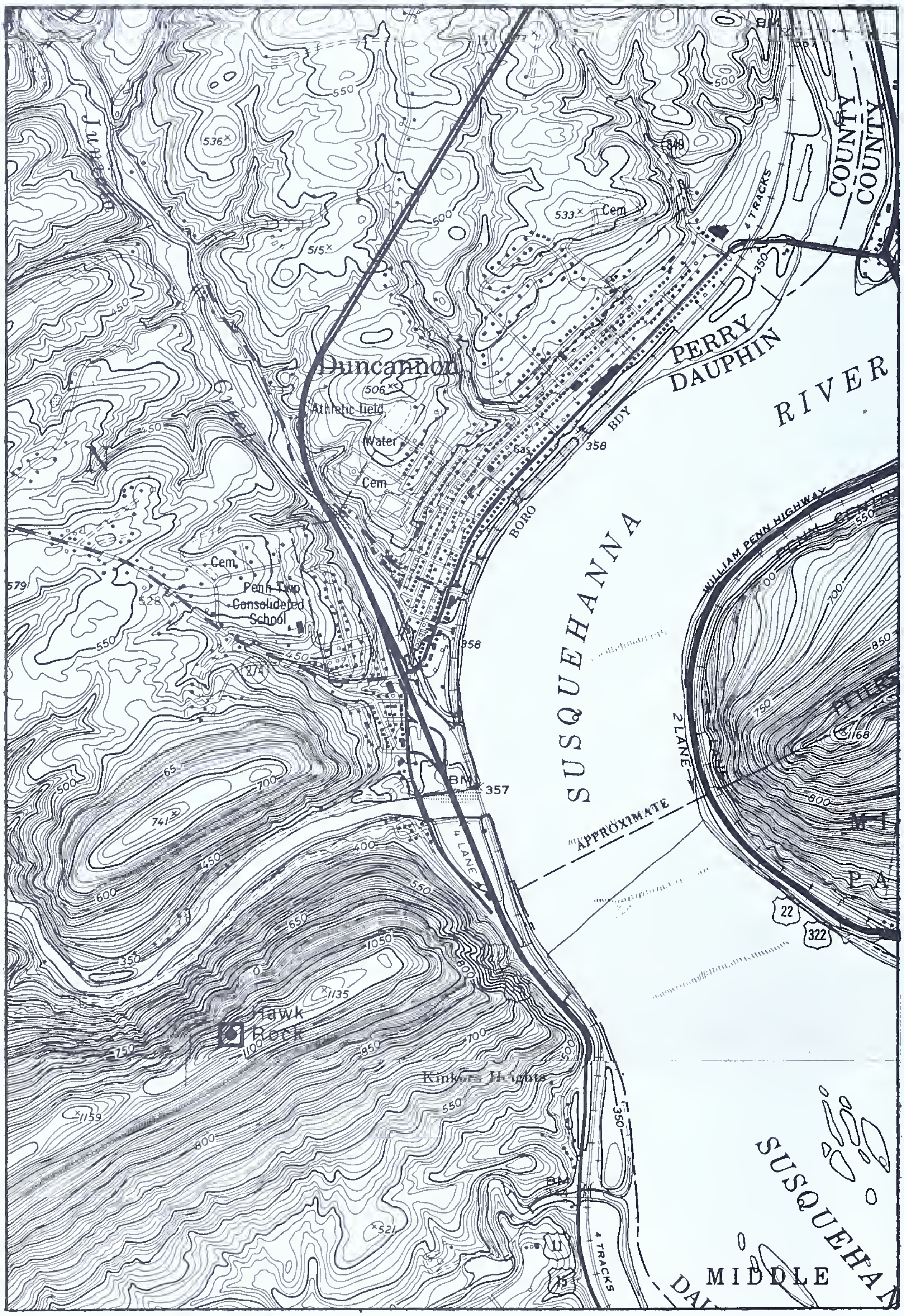
REFERENCES: Dyson, J. L. (1963), *Geology and mineral resources of the northern half of the New Bloomfield quadrangle,* Pennsylvania Geological Survey, 4th ser., Atlas 137ab, 63 p.

Wilshusen, J. P. (1983), *Geology of the Appalachian Trail in Pennsylvania,* Pennsylvania Geological Survey, 4th ser., General Geology Report 74, 121 p.



(Photograph by J. P. Wilshusen)

## 460. **HAWK ROCK** *(continued)*



# 461. INDIAN CHIEF ROCK

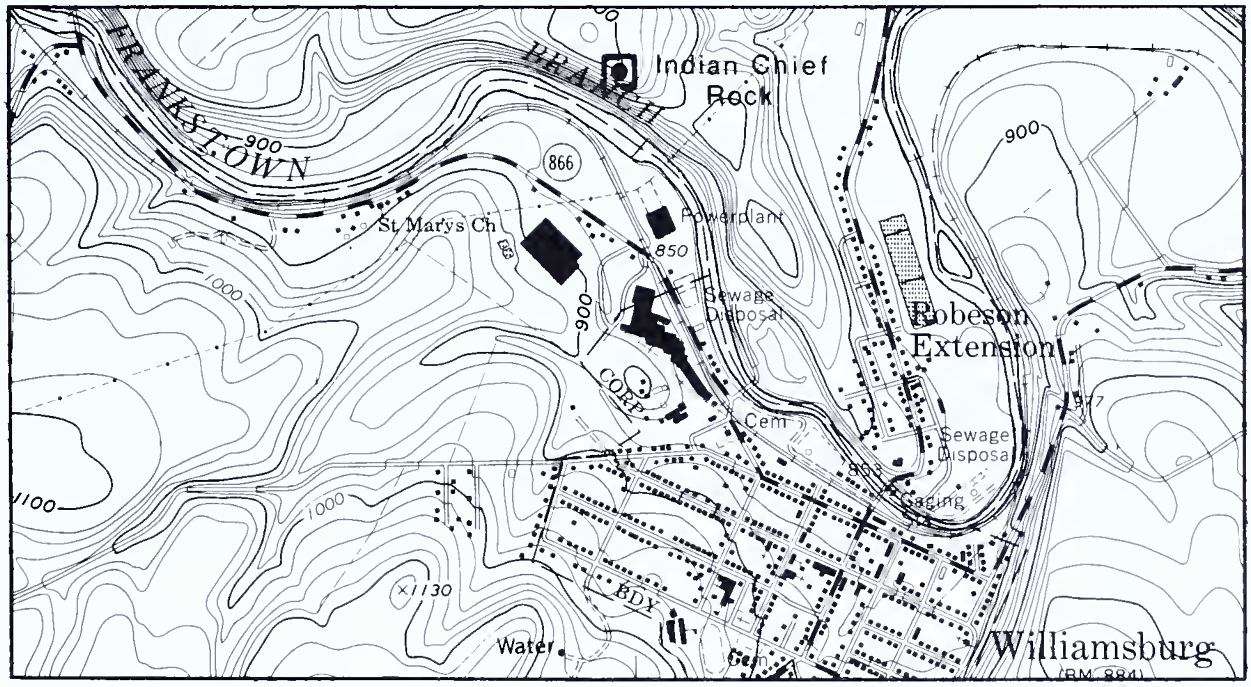
COUNTY: Blair TOWNSHIP: Catharine

QUADRANGLE: Williamsburg

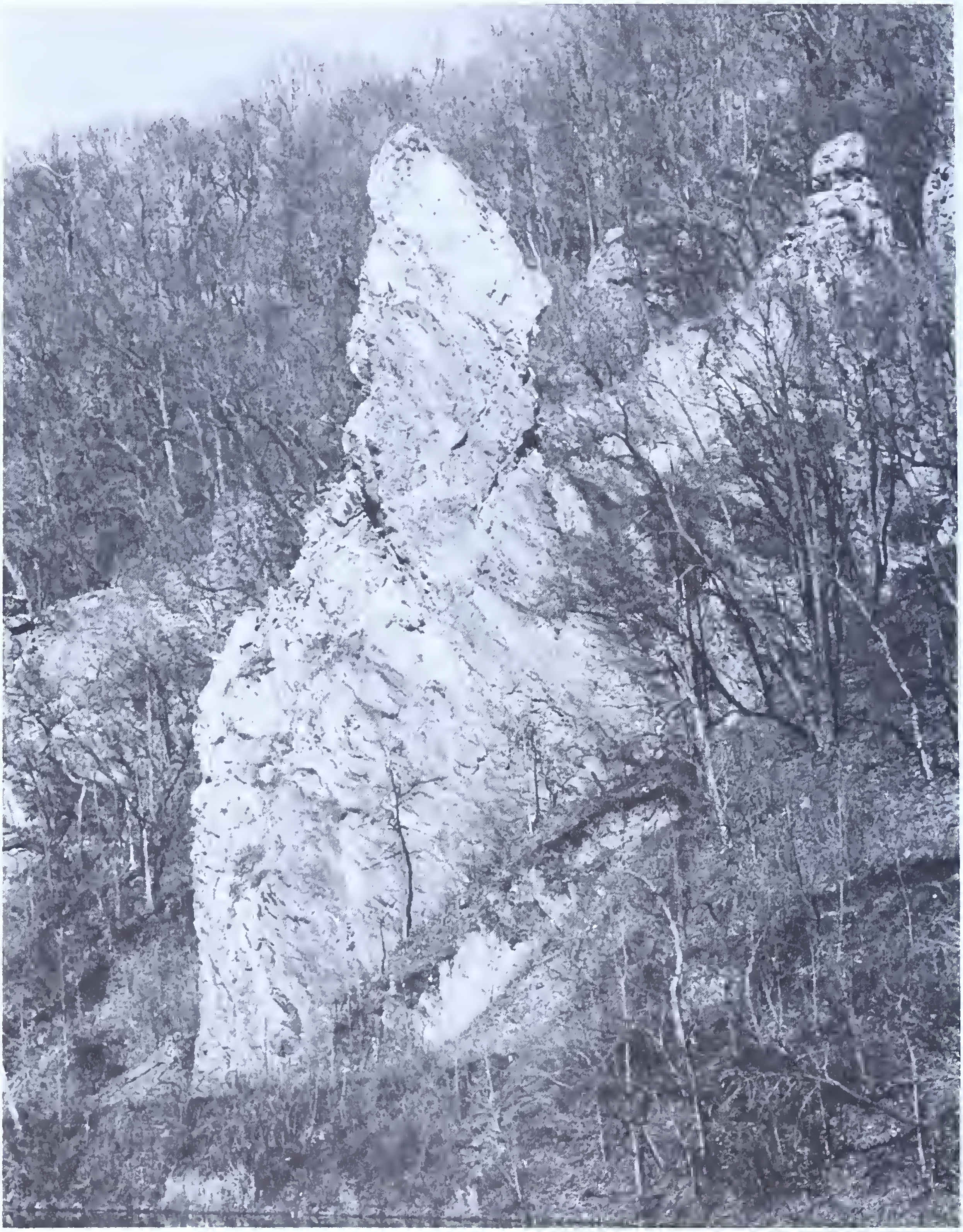
LOCATION: About 0.9 mile northwest of the village of Williamsburg on the north bank of the Frankstown Branch of the Juniata River.

REMARKS: Since 1858, when a sketch of this magnificent geologic feature first appeared in print (Rogers, 1858), little has changed; the artist of over a hundred years ago caught every detail seen today. These vertically dipping layers of light-gray limy sandstone (Gatesburg Formation, Cambrian age) have been sculptured by the elements through geologic time into what appears to look like an Indian in full-length feathered headdress standing on the shore of the river facing the cliff—truly a remarkable feature.

REFERENCE: Rogers, H. D. (1858), *The geology of Pennsylvania, a government survey,* Pennsylvania Geological Survey, 1st ser., v. 1, 586 p., v. 2, 815 p.



## 461. INDIAN CHIEF ROCK *(continued)*



# 462. JACKS NARROWS

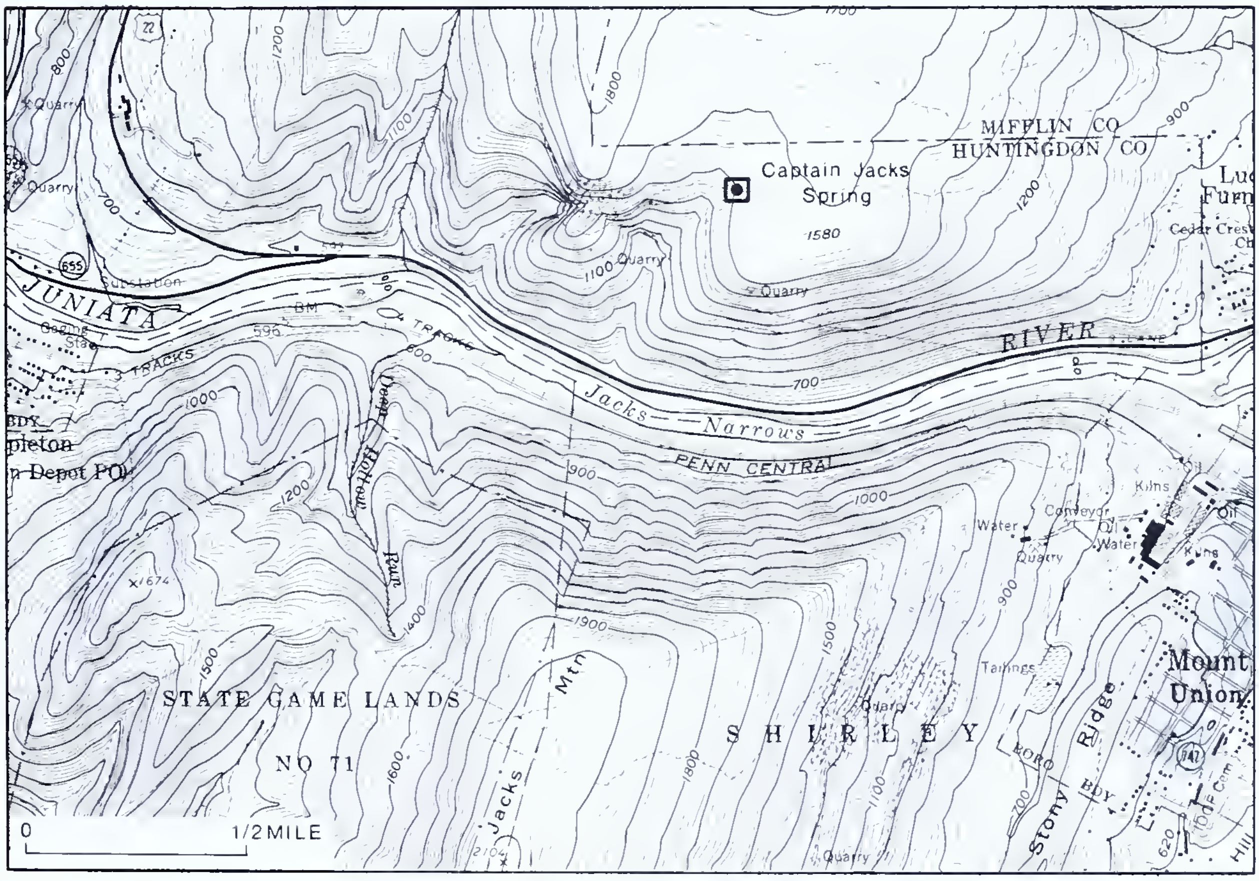
COUNTY: Huntingdon

TOWNSHIPS: Shirley, Union, and Brady

QUADRANGLE: Mount Union

LOCATION: About 0.5 mile west of the borough of Mount Union, along the Juniata River.

REMARKS: A scenic gorge cut by the Juniata River through red sandstone of the Juniata Formation (Ordovician age) and yellowish-brown sandstone of the Tuscarora Formation (Silurian age). **Captain Jacks Spring** (463) is located on the north rim of the gorge.



## 462. JACKS NARROWS *(continued)*

# 464. MAGNESIA SPRING

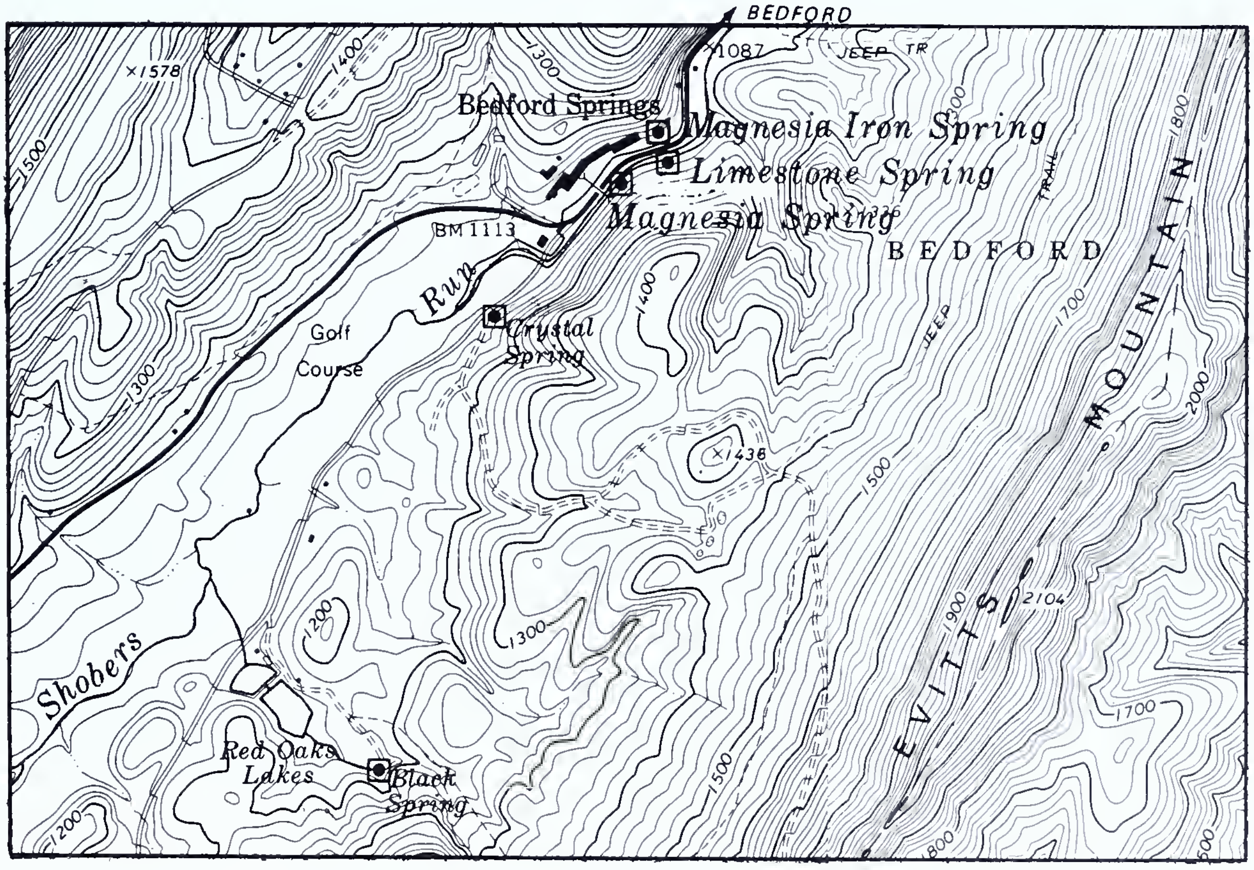
COUNTY: Bedford TOWNSHIP: Bedford

QUADRANGLE: Rainsburg

LOCATION: Approximately 1.6 miles south of the borough of Bedford, at the southeast end of the colonnade linking the spring and the Bedford Springs Hotel.

REMARKS: The spring was first used in 1804 by a local Bedford resident and was reported to have wide-ranging medicinal value. By the early 1900's a large and beautiful spa, the Bedford Springs Hotel, was flourishing.

The aquifer for Magnesia Spring, and for all other springs discussed below, is the sandstone-limestone-chert sequence of rocks associated with the Onondaga and Old Port Formations (Devonian



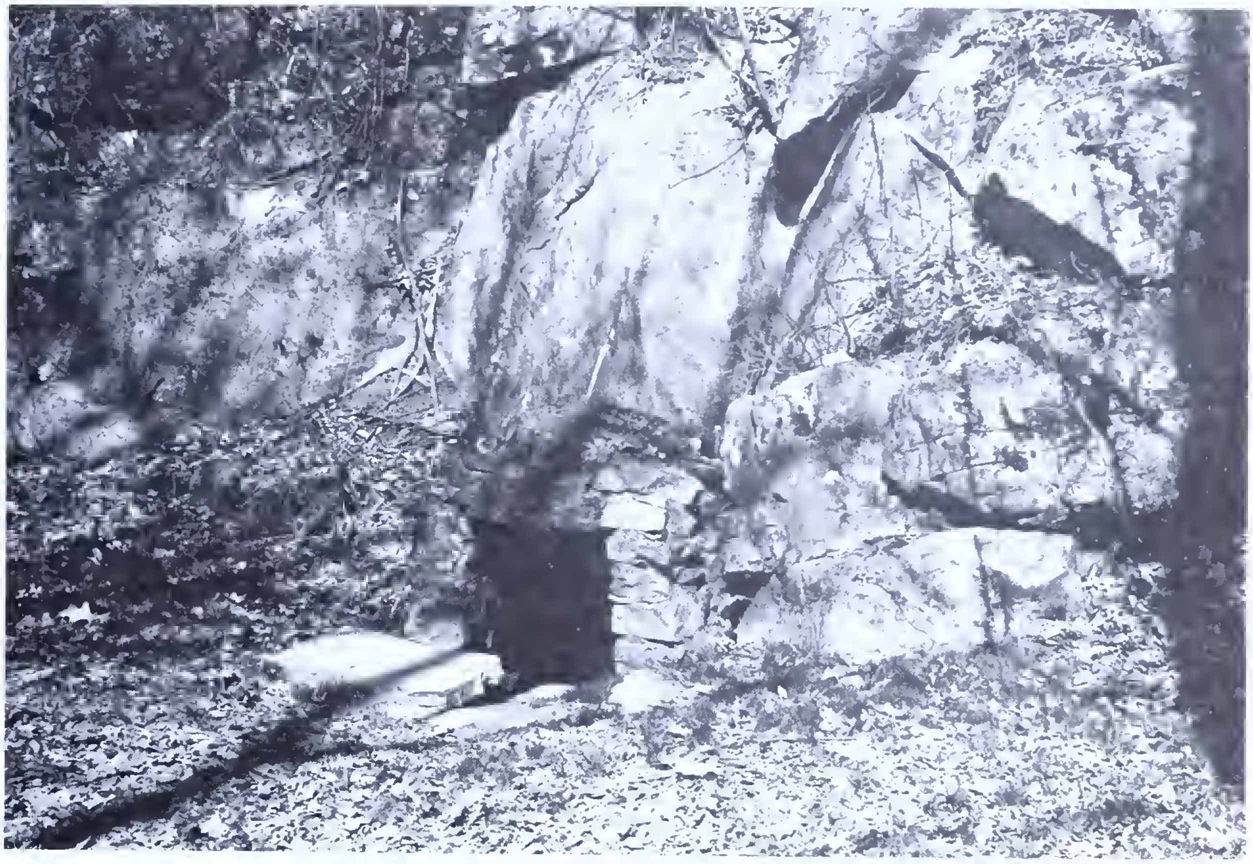
## 464. MAGNESIA SPRING *(continued)*

age). The estimated yield of Magnesia Spring is 30 gallons per minute.

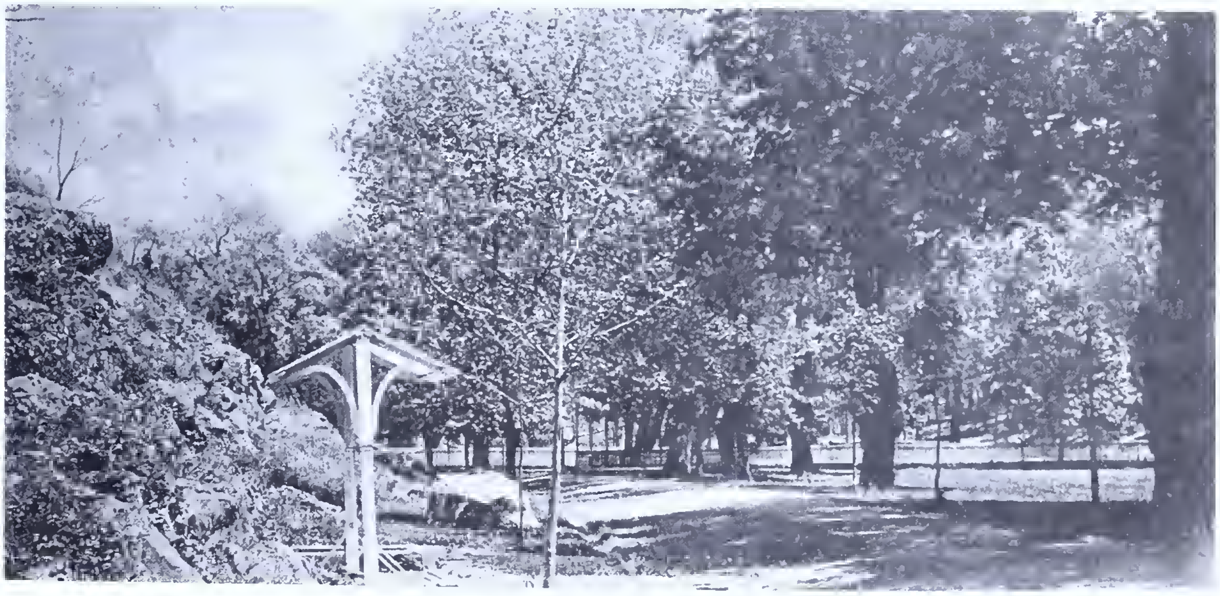
Magnesia Spring is also known as **Magnesium Spring** and **Mineral Spring**. **Magnesia Iron Spring (Sulphur Spring)** (465) is located about 200 feet northeast of the hotel at the base of a small rock cliff. The estimated yield (April 1984) is in excess of 100 gallons per minute. A small stone structure has been erected over the spring.

**Limestone Spring** (466), directly opposite Magnesia Iron Spring, is on the southeast side of Shobers Run and about 200 yards northeast of Magnesia Spring; the path to the spring is marked. The yield is in excess of 100 gallons per minute (April 1984) from a large opening in the rocks. This is a very scenic spring in a rock and hemlock setting.

MAGNESIA SPRING HOUSE



MAGNESIA IRON SPRING



SULPHUR SPRING IN 1906
(From dated postcard)

## 464. MAGNESIA SPRING *(continued)*

**Crystal Spring** (467) is located approximately 1,400 feet southwest of Magnesia Spring; it is a public spring that has been used for bottling water continuously since the 1920's. The measured flow is 12 gallons per minute (April 1984). It is called Crystal Spring because the water is "crystal" clear and no mineral residue remains in the bottles when empty and dry.

**Black Spring** (468), about 0.75 mile southwest of Magnesia Spring, has an estimated yield (April 1984) of 100 gallons per minute. J. J. Stevenson in 1882

LIMESTONE SPRING

CRYSTAL SPRING

referred to this spring as a chalybeate spring. A large reservoir with a roof encloses the spring, which is used to supply the Bedford Springs golf course. The water flows to the golf course by gravity.

All of these springs and several unnamed ones, collectively, are known as the **Bedford Springs**. These are the most famous of Pennsylvania's mineral springs.

CHEMISTRY: A published chemical analysis for Magnesia Spring is as follows: temperature, 16°C; Ca, 558 mg/L (milligrams per liter); Mg, 146 mg/L; $SO_4$, 1,764 mg/L; hardness, 1,994 mg/L $CaCO_3$.

REFERENCES:

Flippo, H. N., Jr. (1974), *Springs of Pennsylvania,* Pennsylvania Department of Environmental Resources, Office of Resources Management, Water Resources Bulletin 10, 46 p.

Stevenson, J. J. (1882), *The geology of Bedford and Fulton Counties,* Pennsylvania Geological Survey, 2nd ser., Report T2, p. 339–346.

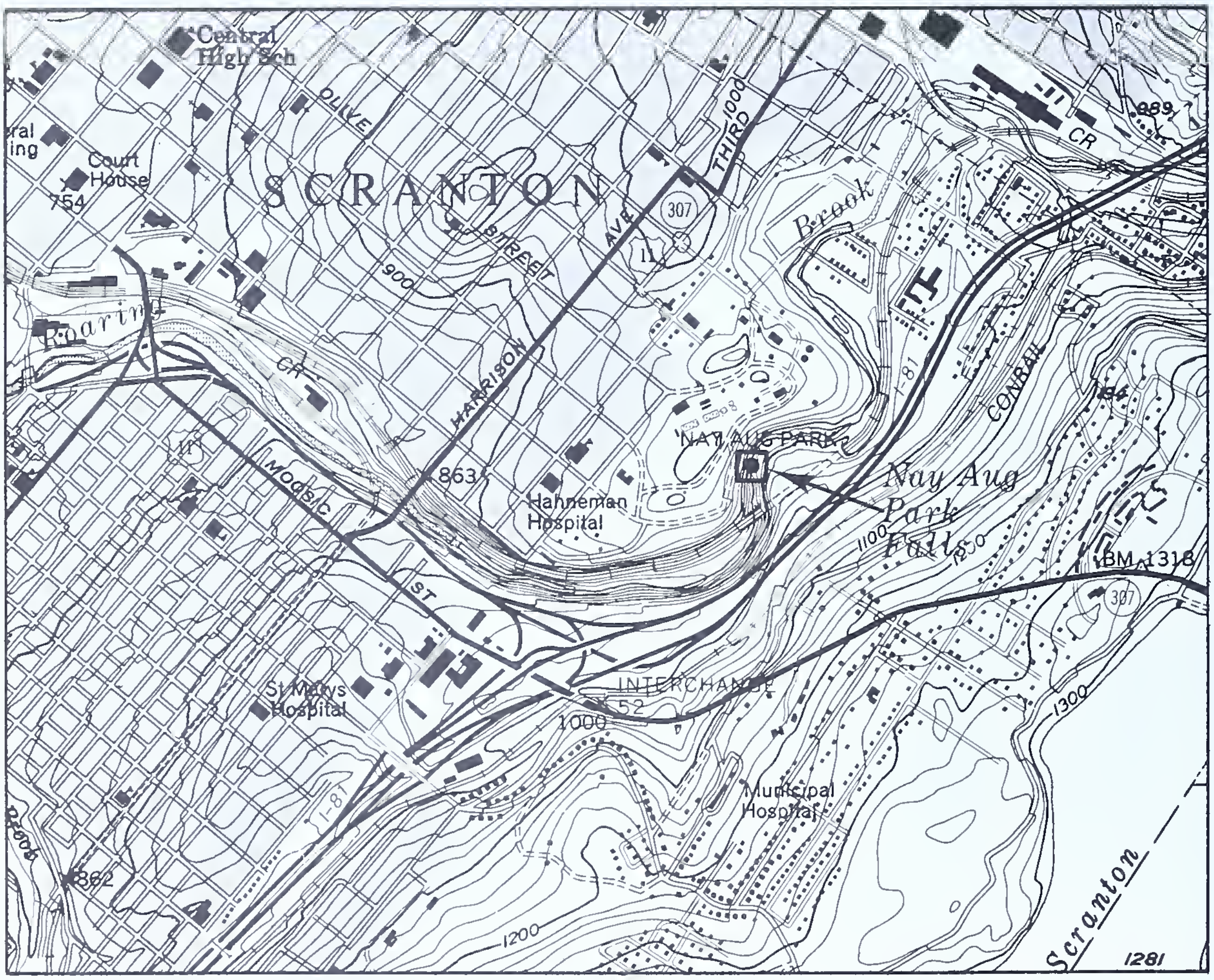
## 469. NAY AUG PARK FALLS

COUNTY: Lackawanna CITY: Scranton

QUADRANGLE: Scranton

LOCATION: City of Scranton, approximately 0.5 mile west of interchange 52 on Interstate Route 81; in a city park.

REMARKS: A waterfall on Roaring Brook passes through this municipal park. Dark-gray to black shales and siltstones of the Llewellyn Formation (Pennsylvanian age) are exposed in the walls of a 75-foot-deep gorge (EG 7, Part 1, site 248).



# VALLEY AND RIDGE PROVINCE

## APPALACHIAN MOUNTAIN SECTION

# 470. ONOKO FALLS

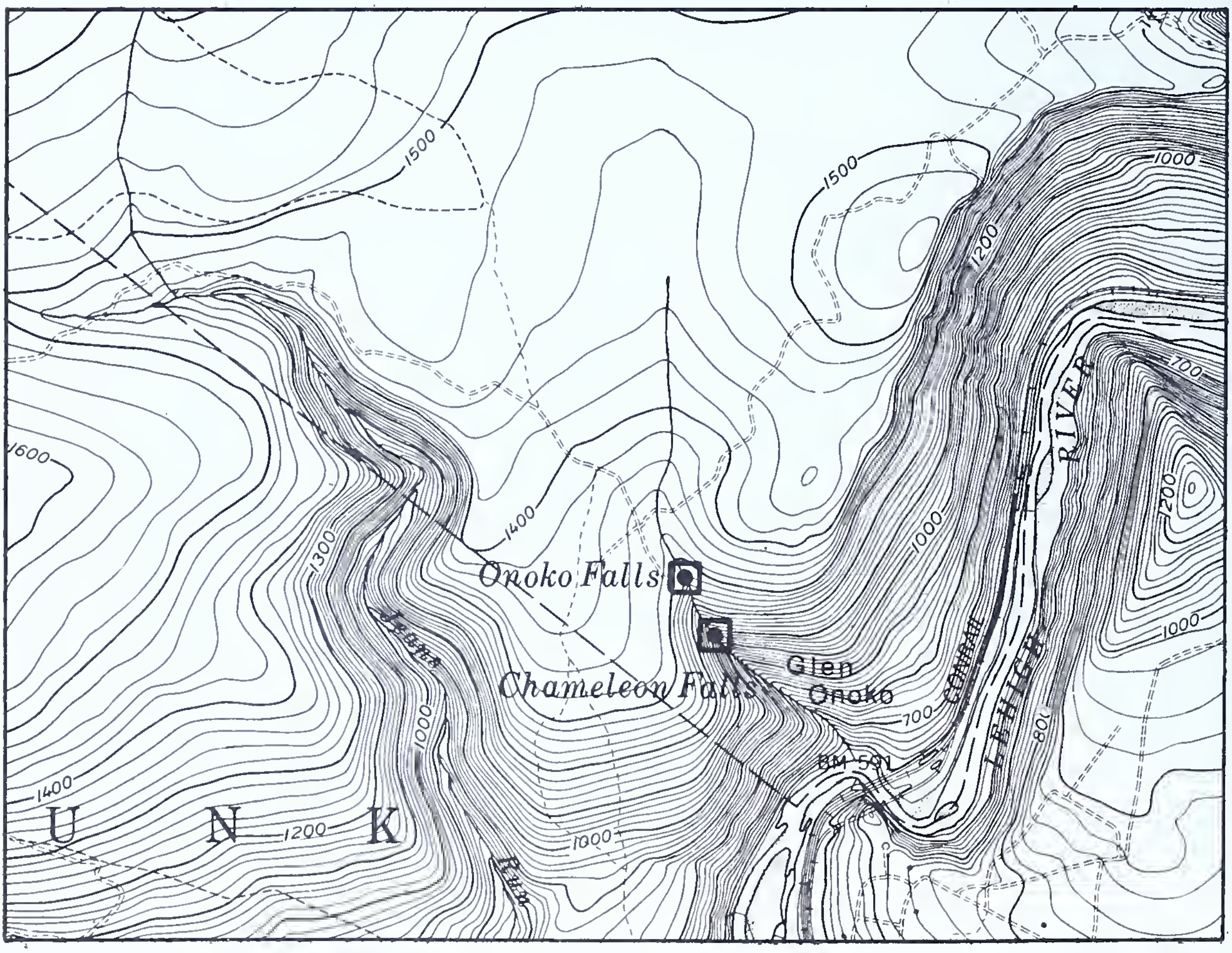
COUNTY: Carbon TOWNSHIP: Lehigh

QUADRANGLE: Weatherly

LOCATION: At Glen Onoko (EG 7, Part 1, site 243) along the Lehigh River, approximately 2 miles up river from the borough of Jim Thorpe.

REMARKS: The small stream in the glen descends 860 feet in approximately 1 mile. A series of picturesque cascades are present. Onoko Falls, which has a drop of 90 feet, and **Chameleon Falls** (471), which has a drop of 150 feet, are the two highest falls in the glen.

REFERENCE: Pennsylvania Geological Survey (1969), *Lehigh River Gorge State Park,* Pennsylvania Geology, v. 1, no. 2, p. 11.



# VALLEY AND RIDGE PROVINCE

## APPALACHIAN MOUNTAIN SECTION

CHAMELEON FALLS

# 472. PENNS CAVE SPRING

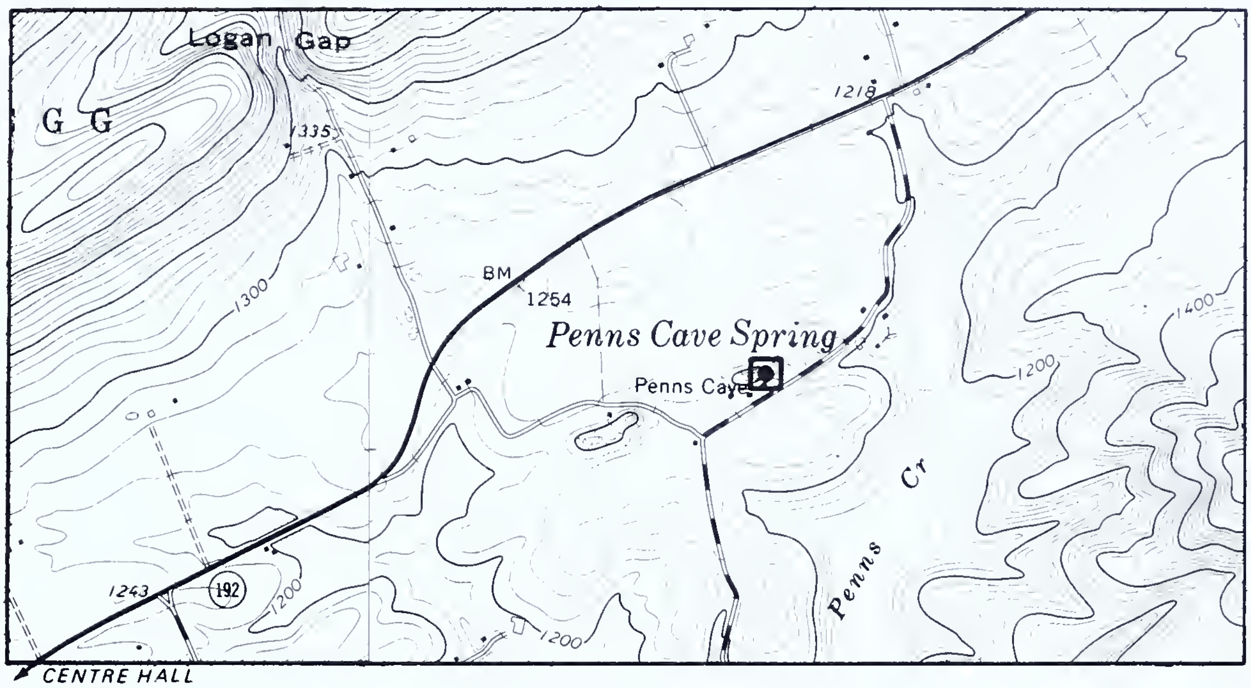
COUNTY: Centre TOWNSHIP: Gregg

QUADRANGLE: Madisonburg

LOCATION: In Brush Valley, 5 miles east of Centre Hall, along Pa. Route 192.

REMARKS: The spring has a reported yield of 6,000 gallons per minute; the aquifer is the limestone of the Nealmont Formation (Ordovician age). The spring is used for recreation (commercial cave), and is at the origin of Penns Creek.

CHEMISTRY: Temperature, 10.0°C; Ca, 55 mg/L (milligrams per liter); Mg, 8.0 mg/L; $HCO_3$, 200 mg/L; $CaCO_3$, 170 mg/L; pH, 7.1.



REFERENCES: Flippo, H. N., Jr. (1974), *Springs of Pennsylvania,* Pennsylvania Department of Environmental Resources, Office of Resources Management, Water Resources Bulletin 10, 46 p.

Shoemaker, H. W. (1914), *Penn's grandest cavern—The history, legends and description of Penn's Cave in Centre County, Pennsylvania,* Altoona, Pa., Altoona Tribune Press, 78 p.

Stone, R. W., Barnsley, E. R., and Hickok, W. O., 4th (1932), *Pennsylvania caves,* Pennsylvania Geological Survey, 4th ser., General Geology Report 3, 2nd ed., p. 41-45.

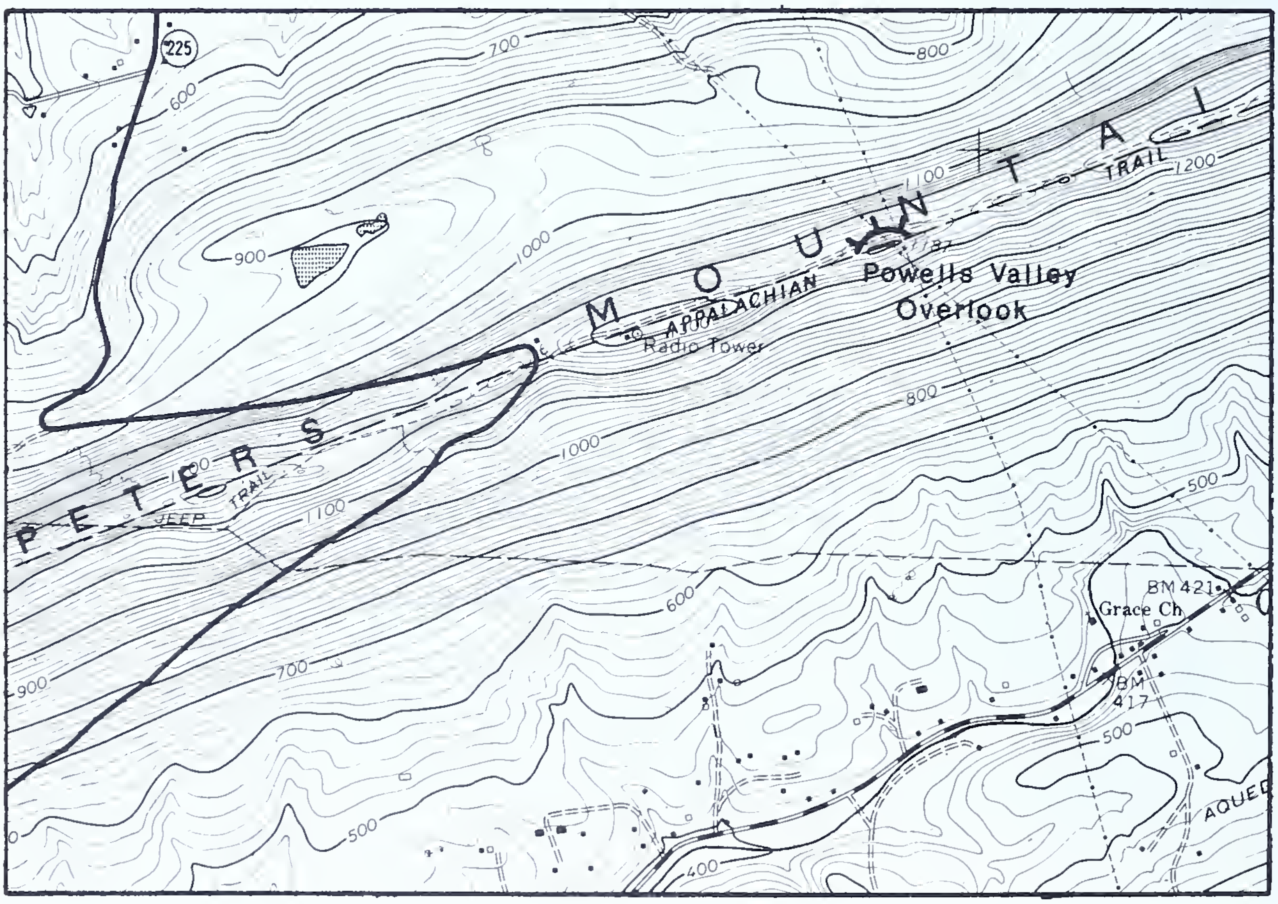
# 473. POWELLS VALLEY OVERLOOK

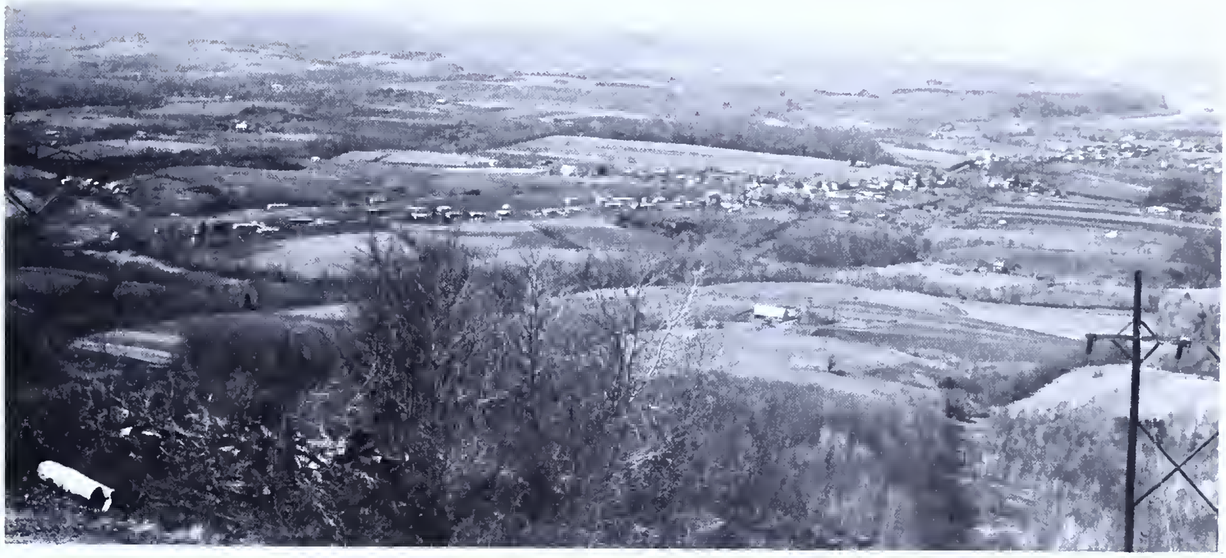
COUNTY: Dauphin TOWNSHIP: Halifax

QUADRANGLE: Halifax

LOCATION: On the Appalachian Trail, approximately 3,200 feet east of the intersection of Pa. Route 225 and the trail, at the crest of Peters Mountain.

REMARKS: The view from this magnificent overlook is to the north across a broad valley underlain by red shale and sandstone (Catskill Formation, Devonian age); Berry Mountain may be seen in the distance. This mountain is composed of hard, resistant sandstone and conglomerate (Pocono Formation, Mississippian age). A water gap cut by the Susquehanna River is also visible.





(Photograph by J. P. Wilshusen)

REFERENCE: Wilshusen, J. P. (1983), *Geology of the Appalachian Trail in Pennsylvania,* Pennsylvania Geological Survey, 4th ser., General Geology Report 74, 121 p.

NOTES:

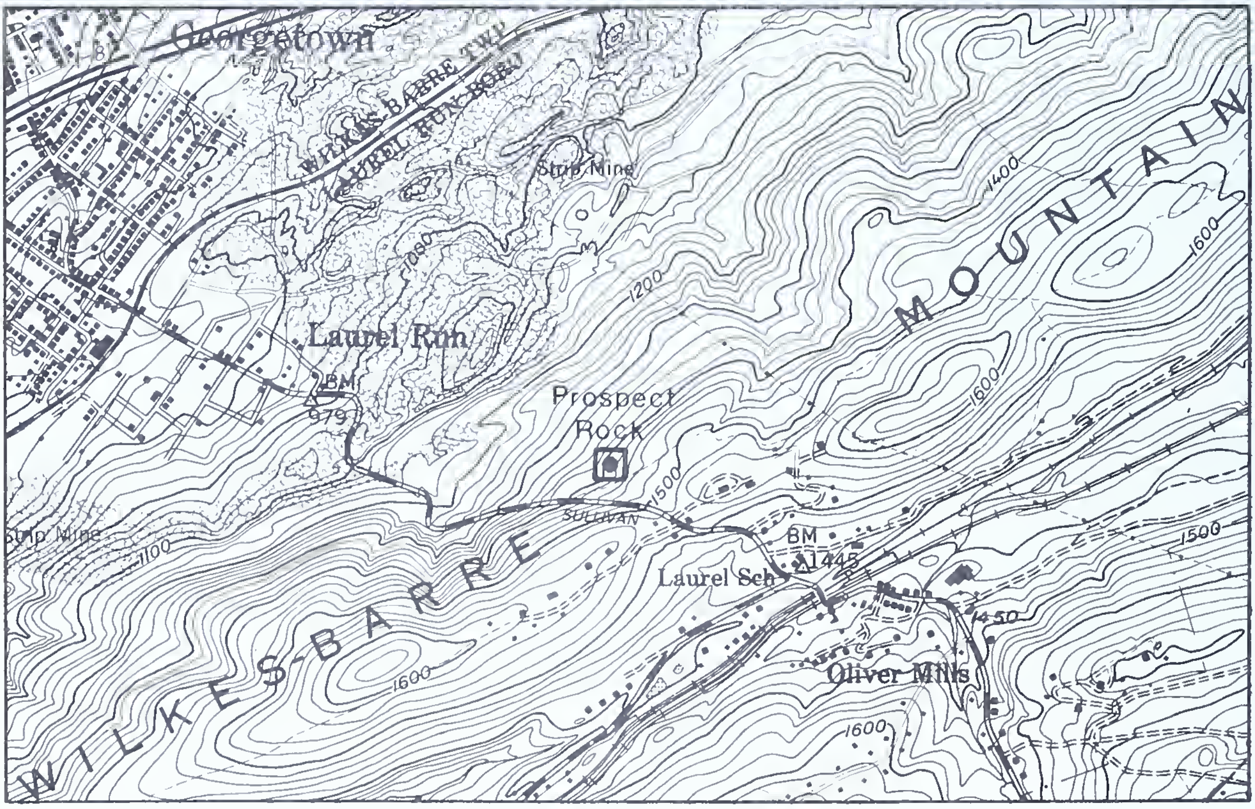
## 474. PROSPECT ROCK

COUNTY: Luzerne BOROUGH: Laurel Run

QUADRANGLE: Wilkes-Barre East

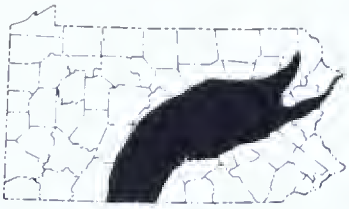
LOCATION: On the north slope of Wilkes-Barre Mountain, 0.4 mile northwest of the village of Oliver Mills, directly behind a large, ornate building along the highway.

REMARKS: Prospect Rock is a large rock ledge, about 200 feet in length, of white pebble conglomerate; the pebbles in the conglomerate are so numerous that they touch each other (Pottsville Group, Pennsylvanian age). From Prospect Rock there is a grand view of the Wyoming Valley and the city of Wilkes-Barre.



# VALLEY AND RIDGE PROVINCE

## APPALACHIAN MOUNTAIN SECTION



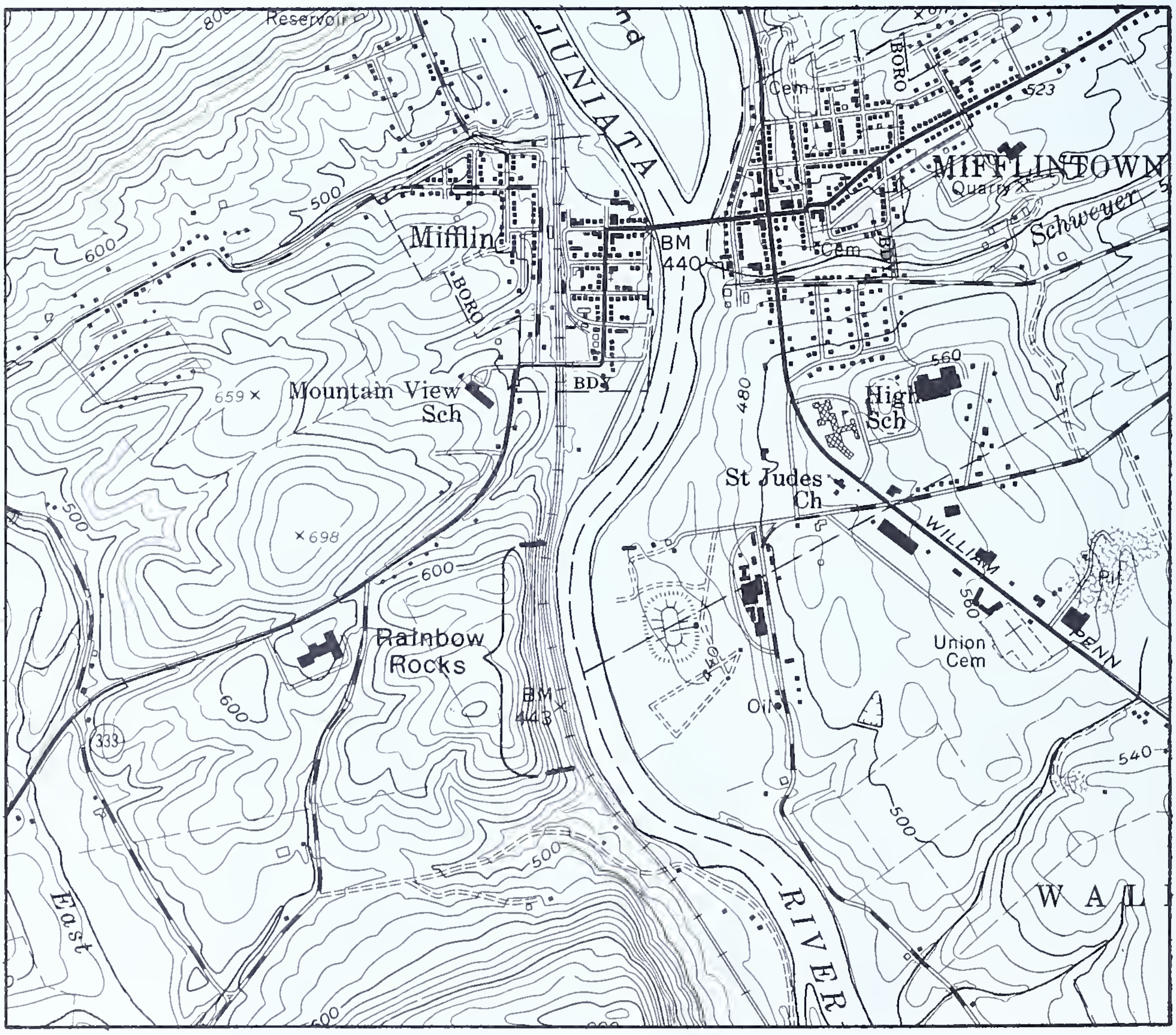
## 475. RAINBOW ROCKS

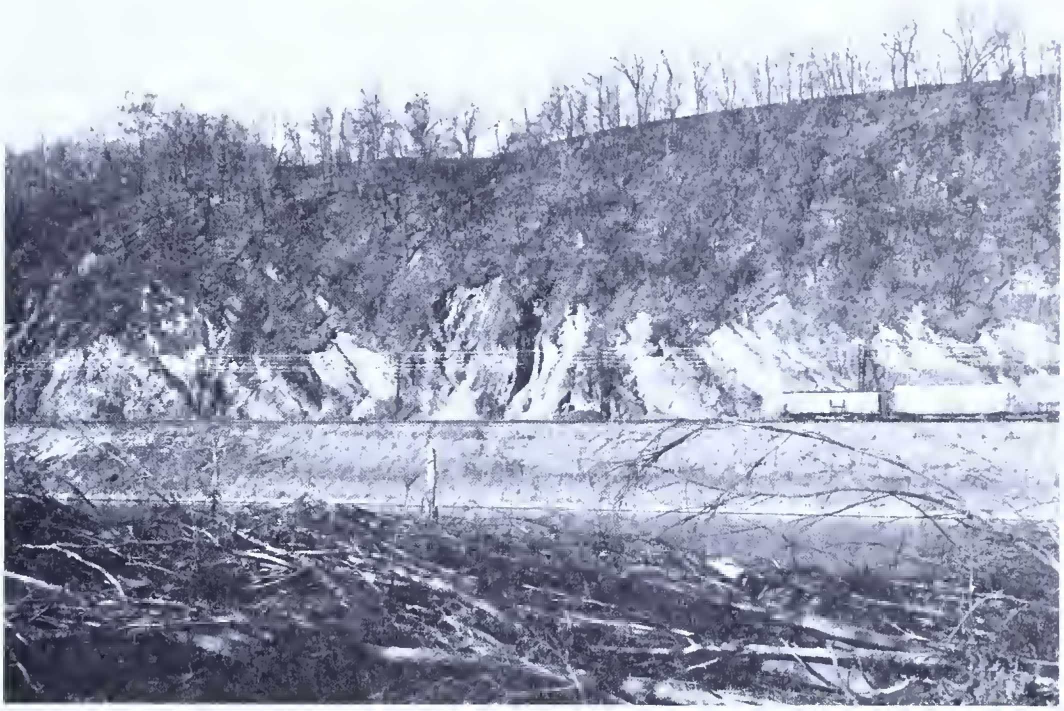
COUNTY: Juniata TOWNSHIP: Milford

QUADRANGLE: Mifflintown

LOCATION: Adjacent to the Conrail tracks on the west side of the Juniata River about 0.8 mile south of the borough of Mifflin.

REMARKS: Rainbow Rocks is a series of anticlines and synclines in the Wills Creek Formation (Silurian age). The rocks received this name from the red and gray-green colors of the shale, siltstone, and sandstone in the folds. Three anticlines and two synclines are exposed over 1,100 feet of continuous





exposure. This site is important to the geology of Pennsylvania because of its extent and the continuous exposure of several folds showing typical third-order Appalachian folding and microstructures. Rainbow Rocks is an excellent site for use in teaching earth science.

REFERENCES:

Conlin, R. R., and Hoskins, D. M. (1962), *Geology and mineral resources of the Mifflintown quadrangle, Pennsylvania,* Pennsylvania Geological Survey, 4th ser., Atlas 126, p. 35.

Nickelsen, R. P., and Faill, R. T. (1973), *Stop II: "Rainbow Rocks", an exposure of fold geometry and minor structures in the Wills Creek Formation,* in Faill, R. T., ed., *Structure and Silurian-Devonian stratigraphy of the Valley and Ridge province, central Pennsylvania,* Annual Field Conference of Pennsylvania Geologists, 38th, Camp Hill, Pa., Guidebook, p. 68–74.

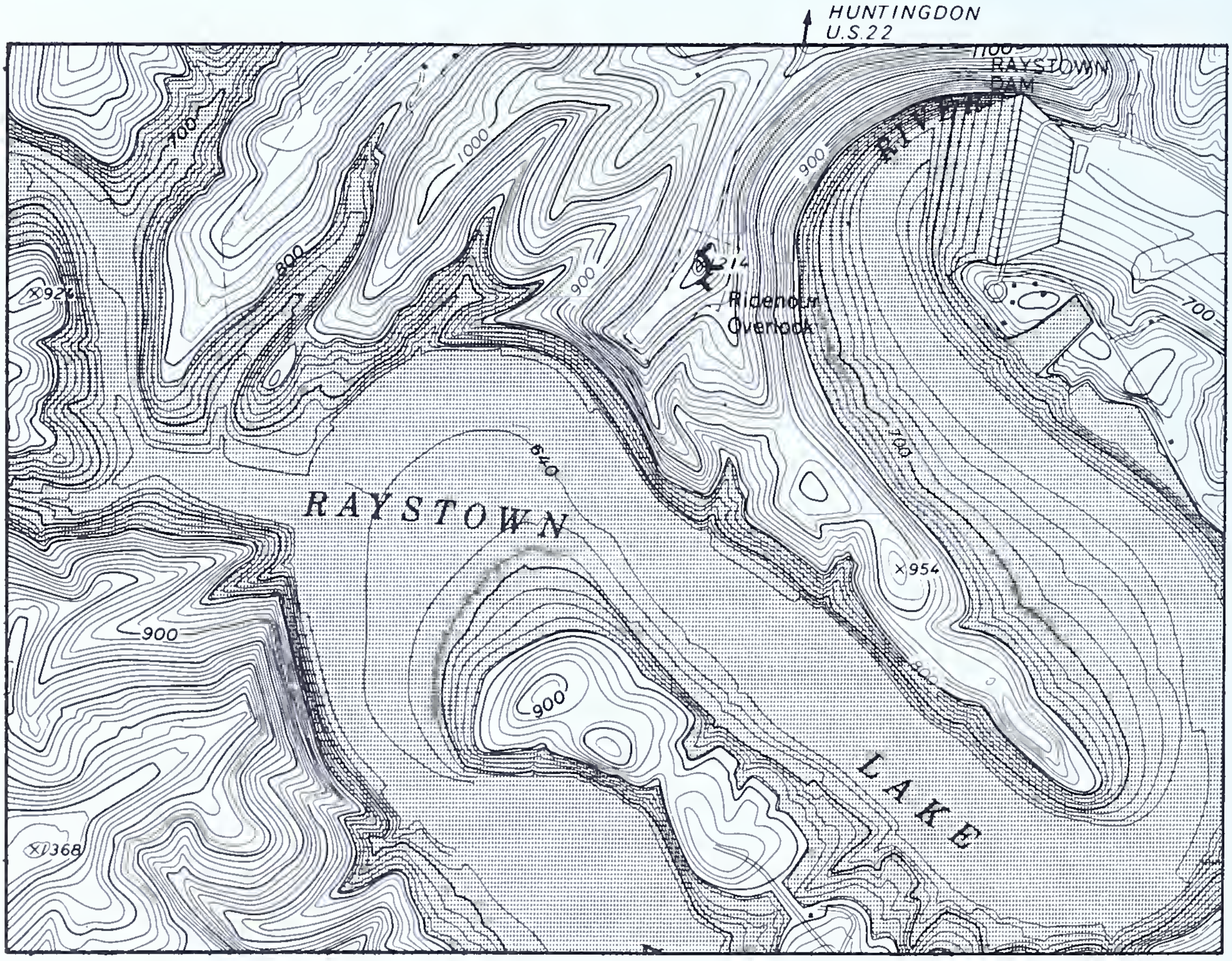
## 476. RIDENOUR OVERLOOK

COUNTY: Huntingdon TOWNSHIP: Juniata

QUADRANGLE: Huntingdon

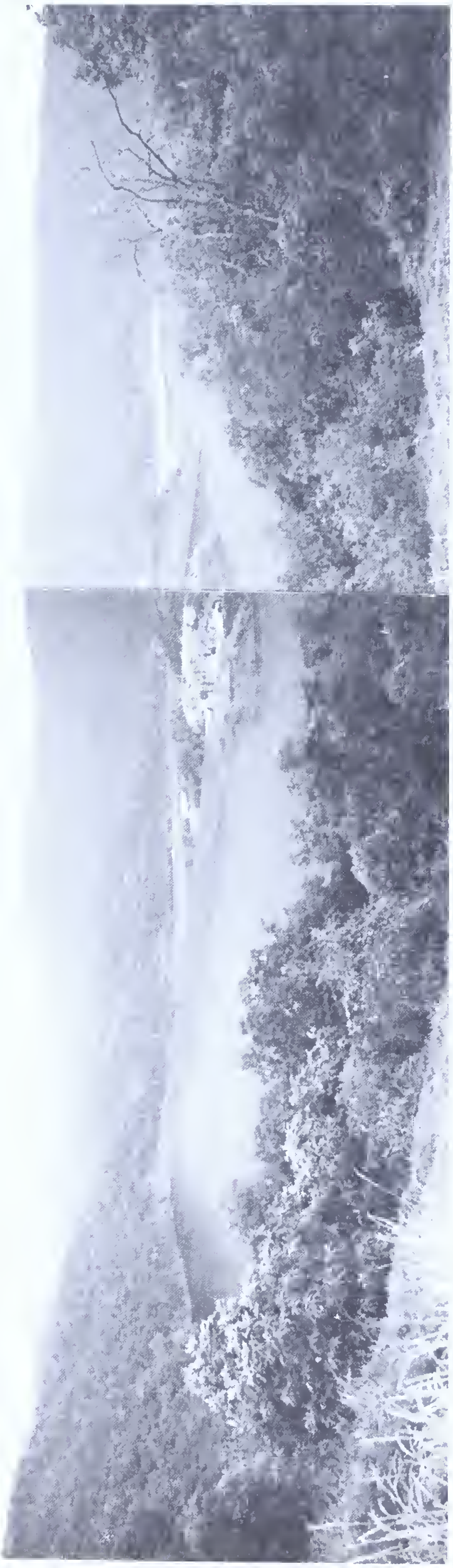
LOCATION: About 3.9 miles from U.S. Route 22 at Huntingdon, on U.S. Army Corps of Engineers property surrounding Raystown Lake and Dam; signs to the overlook are maintained from U.S. Route 22 to the site.

REMARKS: Hard, tough sandstone (Foreknobs Formation, Devonian age) that weathers relatively slowly accounts for the high hill here, which affords a beautiful view of Raystown Lake and Dam. Similar overlooks to the south include **Hawns Overlook** (477), **Coffee Run Overlook** (478), and **Entriken Bridge Overlook** (479).



# VALLEY AND RIDGE PROVINCE

## APPALACHIAN MOUNTAIN SECTION



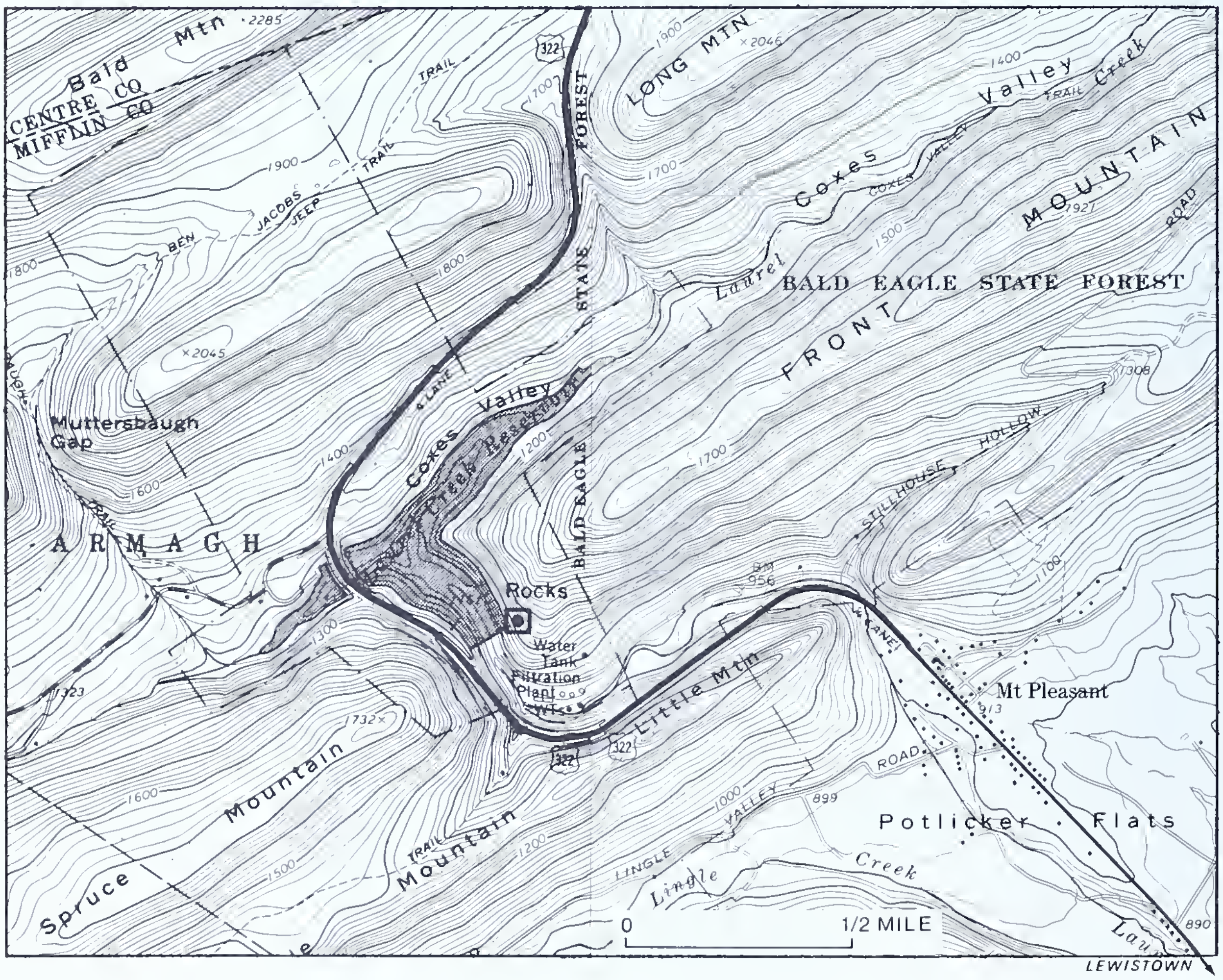
# 480. ROCKS AT LAUREL CREEK RESERVOIR

COUNTY: Mifflin TOWNSHIP: Armagh

QUADRANGLE: Barrville

LOCATION: Along U.S. Route 322, about 10 miles northwest of Lewistown. The Laurel Creek Reservoir occupies part of Coxes Valley and the water gap between Spruce Mountain (to the west) and Front Mountain (to the east) in a region of central Pennsylvania known as the Seven Mountains.

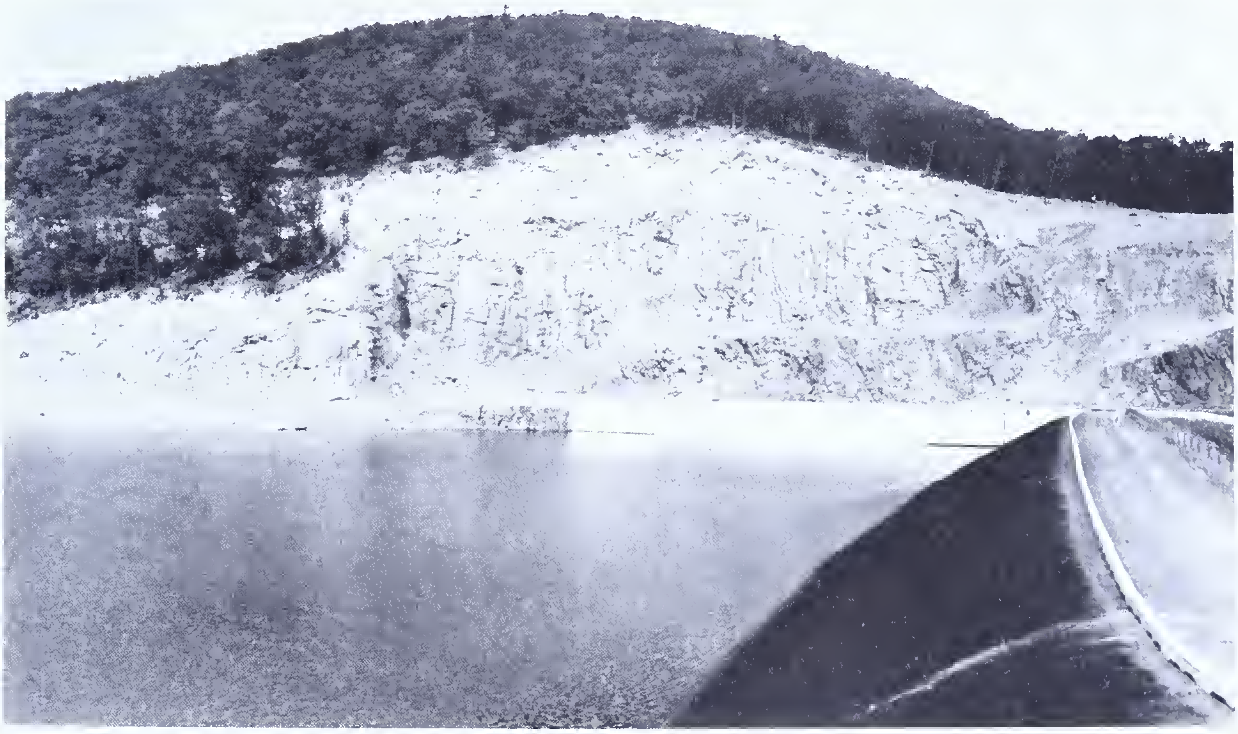
REMARKS: A continuous rock exposure of the upper part of the Juniata Formation (Ordovician age), the Tuscarora Formation (Silurian age), and most of the overlying Rose Hill shale (Silurian age) is present. The bedding



is nearly vertical and an early (before much bed rotation) kink-band fold in the quartzite of the Tuscarora Formation is outstanding. A few wide kinks are especially impressive.

This site is geologically outstanding because it shows (1) an unusual situation of relatively small kinks (folds) in thick-bedded, so-called "competent" quartzite; (2) an unusual sequence of events—early kink-band folding, followed by the major folding, and then faulting; (3) in the Rose Hill shales to the north, one of the most intense pressure-solution cleavages seen within the Valley and Ridge province; and (4) one hundred percent of the clastic rocks of the Tuscarora Formation, especially the black shale/white quartzite interbedding.

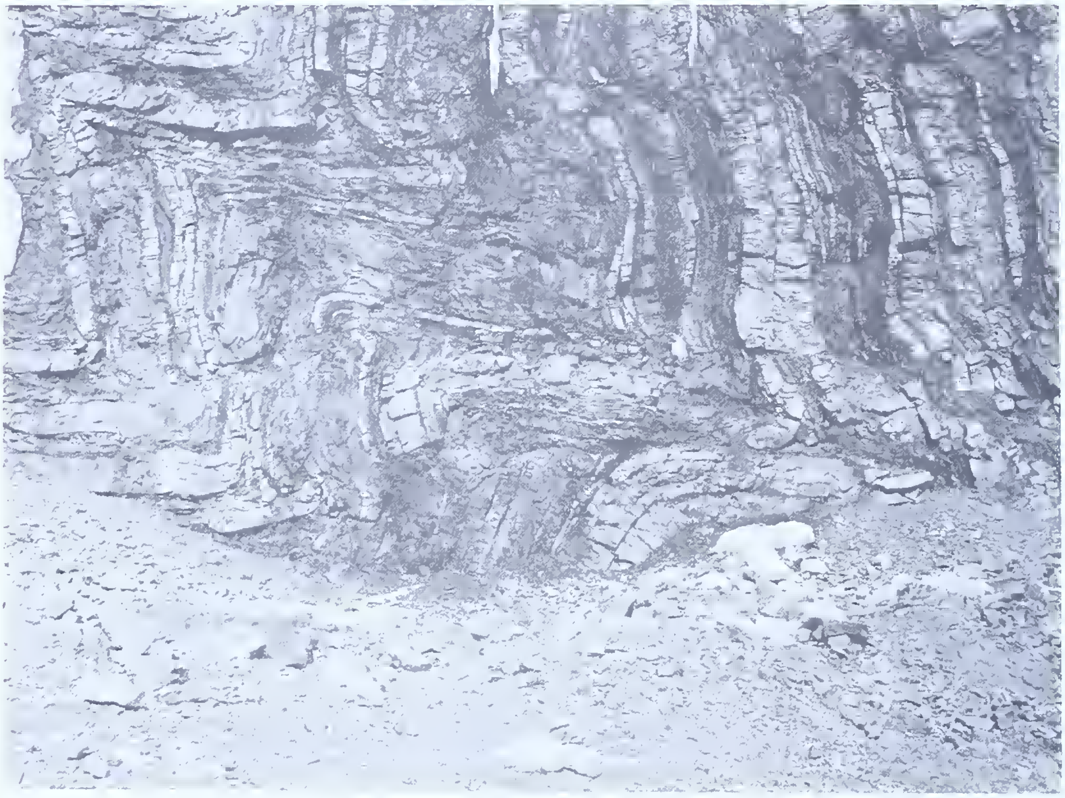
U.S. Route 322, which follows the route of an old Indian path, winds its way through the tree-covered hills surrounding the reservoir. The route around and



(Photograph by R. T. Faill)

## 480. ROCKS AT LAUREL CREEK RESERVOIR *(continued)*

adjacent to the reservoir, which has a steep grade and several sharp curves, is known as the **Devils Elbow** (481).



(Photograph by R. T. Faill)

NOTES:

# 482. SPRING MEADOW SPRING

COUNTY: Bedford TOWNSHIP: East Saint Clair

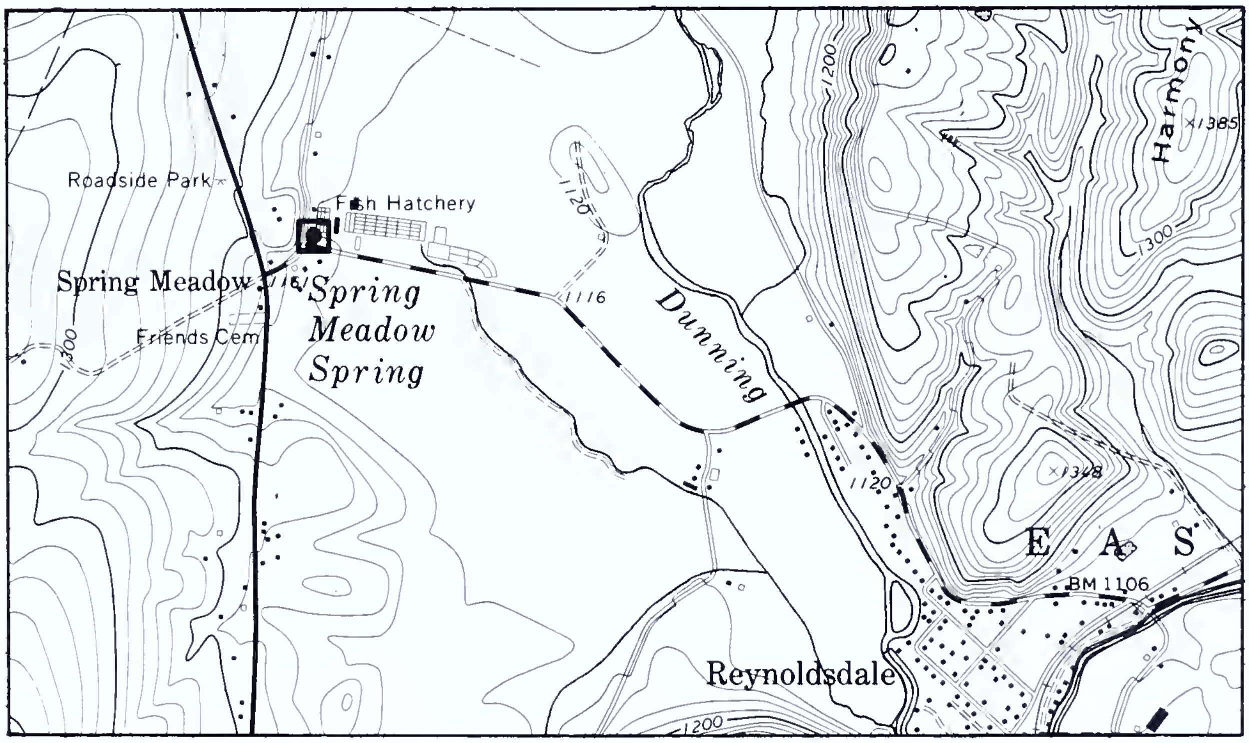
QUADRANGLE: Alum Bank

LOCATION: Approximately 1.2 miles northwest of the village of Reynoldsdale at the Reynoldsdale Fish Culture Station (Pennsylvania Fish Commission).

REMARKS: A large spring with a measured yield (November 10, 1971) of 1,600 gallons per minute issues from sandstone of the Old Port Formation (Devonian age).

A fish culture station was established at this site in 1928; today, visitors are provided with a large educational center containing two floors of fish display tanks and other exhibits.

CHEMISTRY: A partial chemical analysis of the water is as follows: temperature, 52°F; Ca, 58 mg/L (milligrams per liter); $SO_4$, 130 mg/L; $CaCO_3$, 198 mg/L; pH, 7.6.



## 482. SPRING MEADOW SPRING *(continued)*

REFERENCE: Flippo, H. N., Jr. (1974), *Springs of Pennsylvania,* Pennsylvania Department of Environmental Resources, Office of Resources Management, Water Resources Bulletin 10, 46 p.

NOTES:

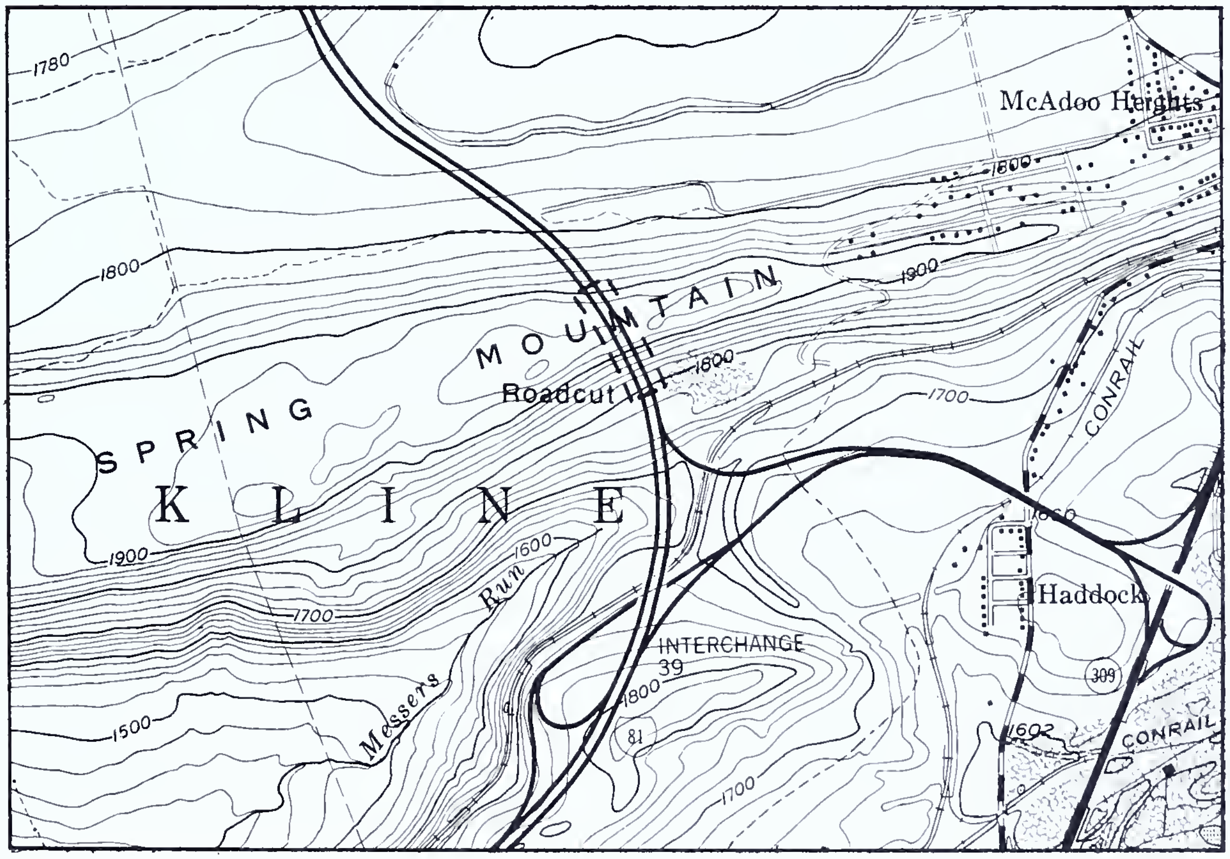
# 483. SPRING MOUNTAIN THRUST FAULT

COUNTY: Schuylkill TOWNSHIP: Kline

QUADRANGLE: Conyngham

LOCATION: Approximately 0.7 mile north of interchange 39 on Interstate Route 81, at mile 138.

REMARKS: A deep roadcut in Spring Mountain exposes one large, high-angle thrust fault (Spring Mountain thrust fault) and two low-angle thrust faults. The basic structure is a syncline in which the rock layers are broken by faults. The light-gray and brown sandstones and conglomerates of the Pottsville Formation (Pennsylvanian age) on the south side of the syncline have been thrust over the rock layers on the north side by at least 50 feet. This faulting took



## 483. SPRING MOUNTAIN THRUST FAULT *(continued)*

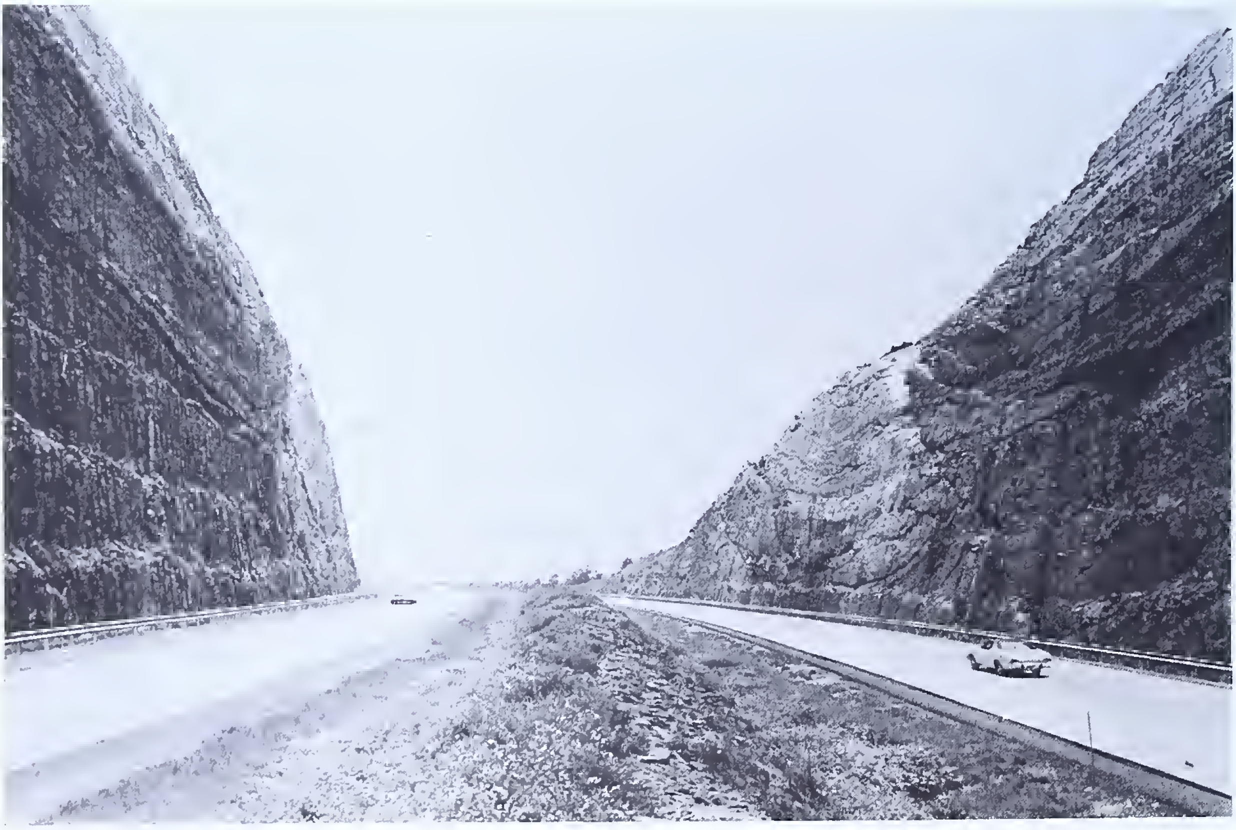
place about 250 million years ago, leaving the record in the rock that is visible here.

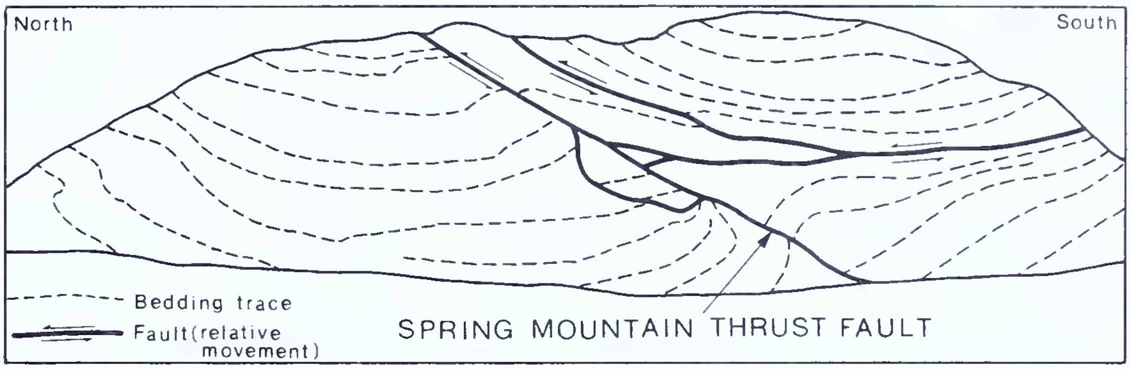
This is the most dramatic exposure of a thrust fault in Pennsylvania.

REFERENCES: Bolles, W. H., and Geyer, A. R. (1976), *Pennsylvania Interstate 81—Geologic guide,* Pennsylvania Department of Education and Pennsylvania Department of Environmental Resources, 35 p.

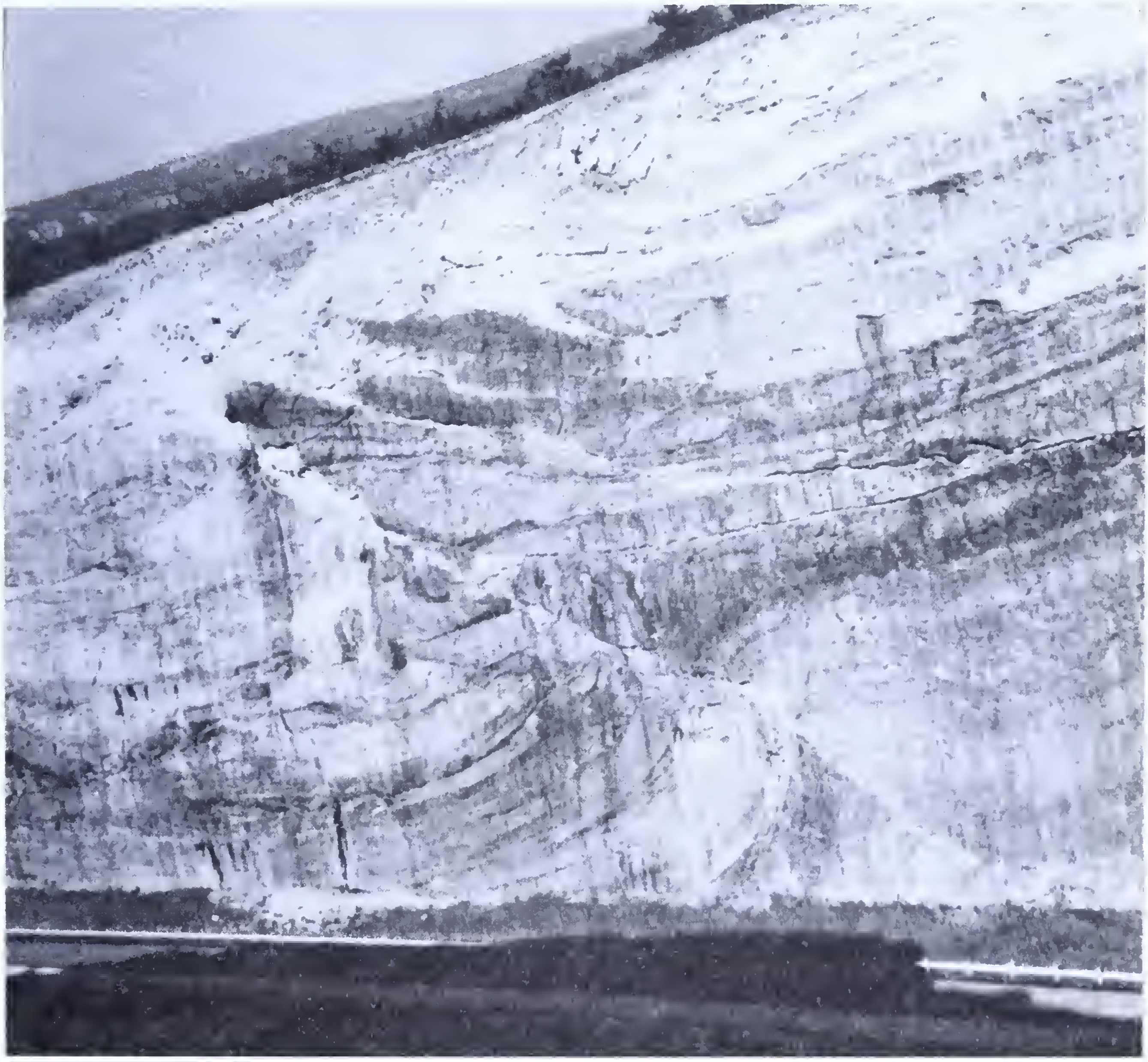
Faill, R. T., and Wells, R. B. (1970), *A fault near Hazleton,* Pennsylvania Geology, v. 1, no. 5, p. 9–10.

Sevon, W. D., Rose, A. W., Smith, R. C., II, and Hoff, D. T., leaders (1978), *Uranium in Carbon, Lycoming, Sullivan, and Columbia Counties, Pennsylvania,* Annual Field Conference of Pennsylvania Geologists, 43rd, Hazleton, Pa., Guidebook, 99 p.





(Modified from Bolles and Geyer, 1976, p. 21)



(Photograph from Faill and Wells, 1970, p. 9)

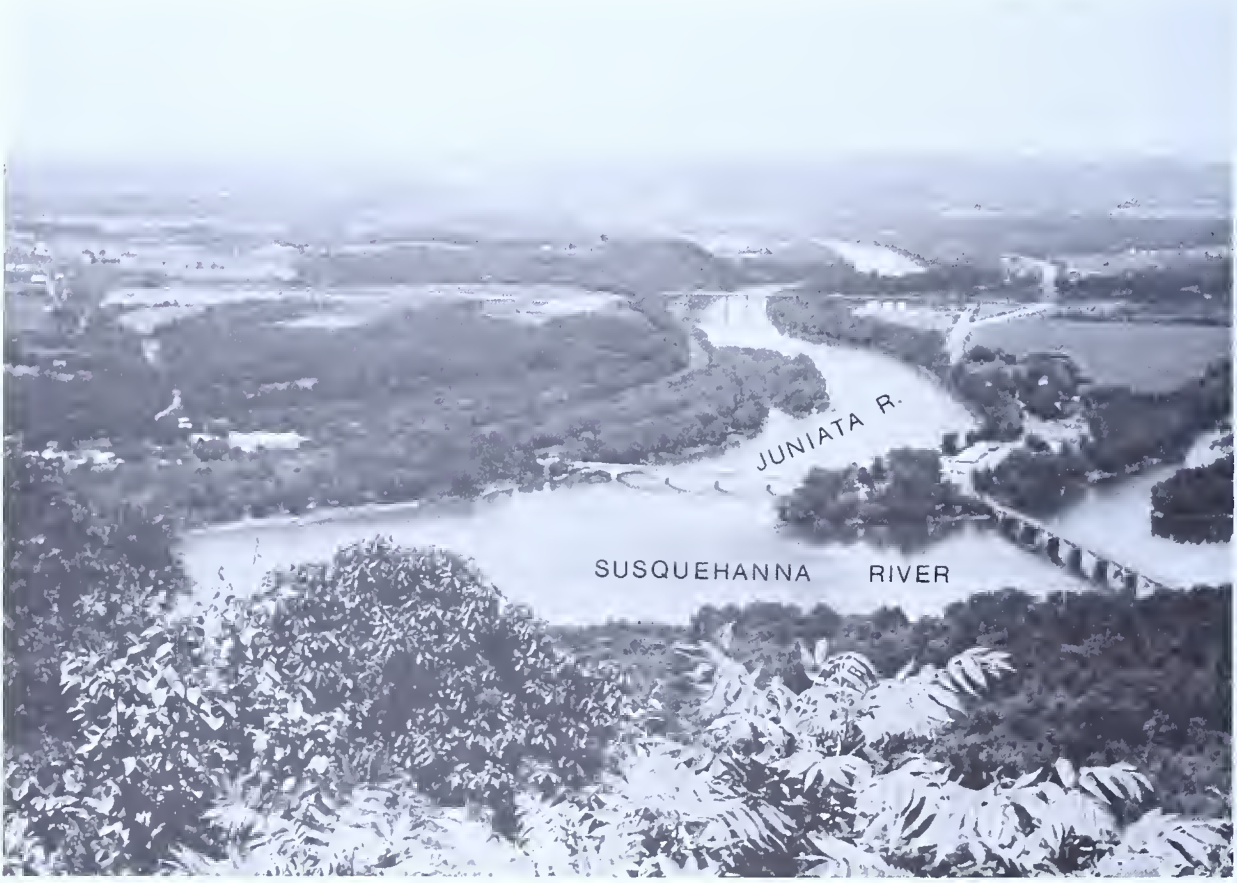
## 484. SUSQUEHANNA RIVER OVERLOOK

COUNTY: Dauphin TOWNSHIP: Middle Paxton

QUADRANGLE: Duncannon

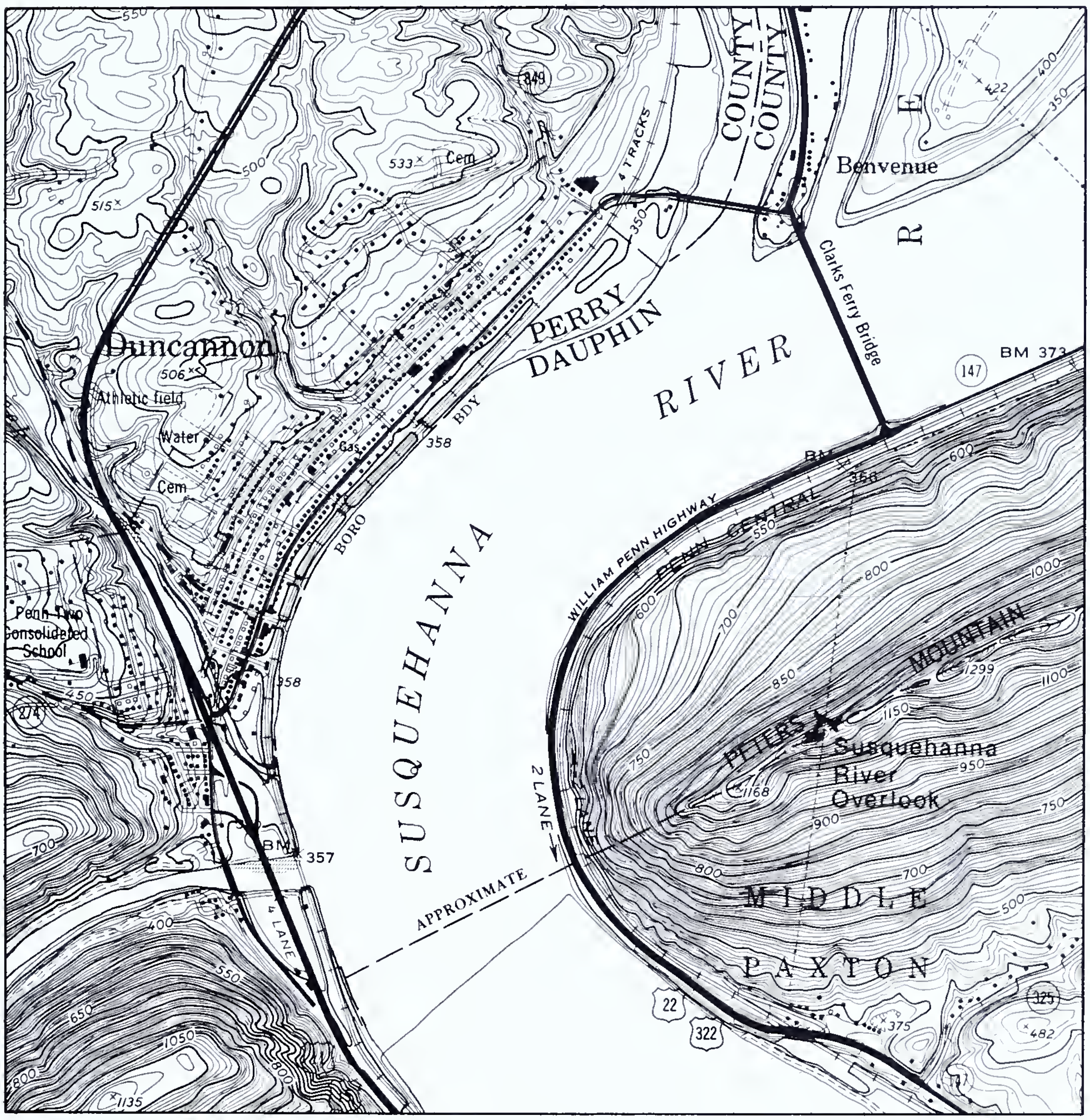
LOCATION: Along the Appalachian Trail on Peters Mountain opposite the borough of Duncannon.

REMARKS: An outstanding overlook with a magnificent view to the north of the Susquehanna and Juniata River valleys and parallel ridge tops in the background. The valleys here are underlain by red sandstone and shale of the Catskill Formation (Devonian age), one of the most widespread rock units in central and eastern Pennsylvania.



(Photograph by J. P. Wilshusen)

REFERENCE: Wilshusen, J. P. (1983), *Geology of the Appalachian Trail in Pennsylvania,* Pennsylvania Geological Survey, 4th ser., General Geology Report 74, 121 p.



## 485. VALLEY DAIRY SPRING

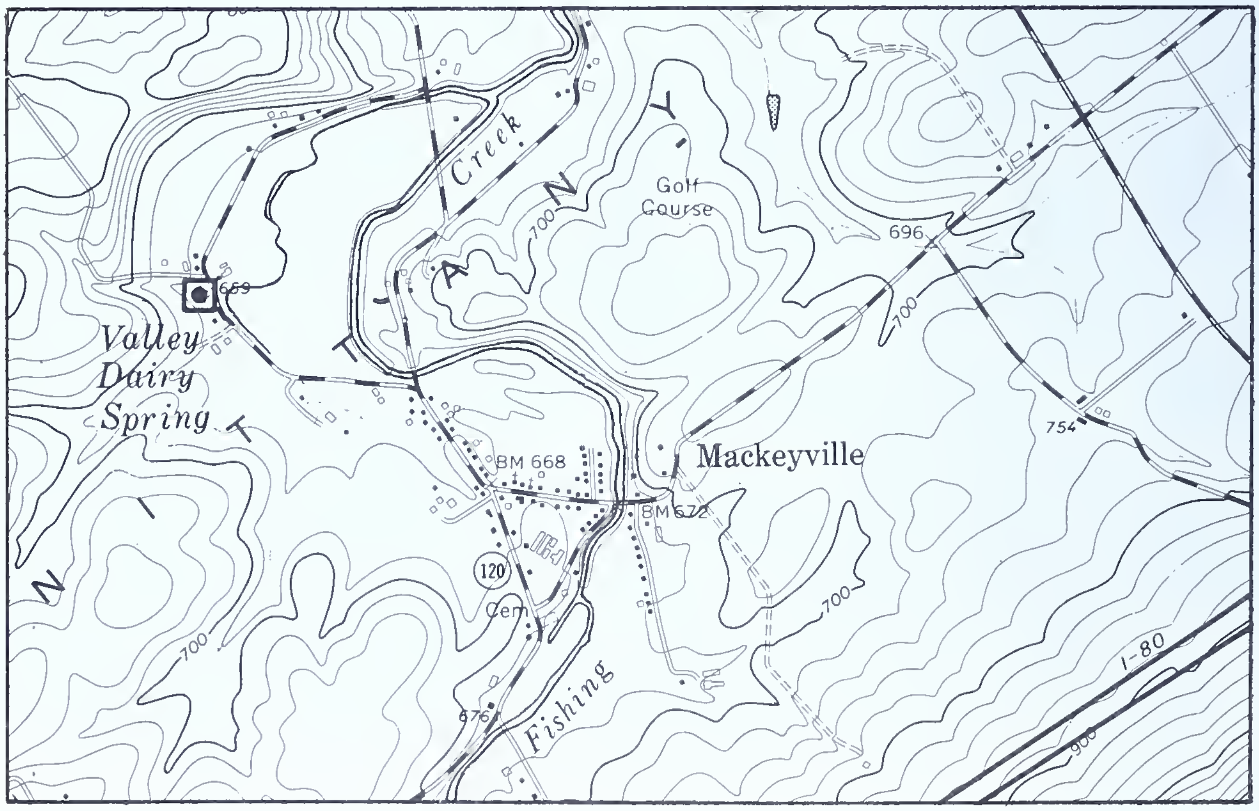
COUNTY: Clinton TOWNSHIP: Lamar

QUADRANGLE: Mill Hall

LOCATION: In the Nittany Valley along an unnamed tributary to Fishing Creek, 0.5 mile northwest of the village of Mackeyville.

REMARKS: The spring issues from a solution channel in dolomite of the Bellefonte Formation (Ordovician age). The spring, which has a measured yield of 4,000 gallons per minute (November 11, 1971), is in a very picturesque setting. The water is used for agricultural purposes.

CHEMISTRY: Temperature, 9.5°C; Ca, 29 mg/L (milligrams per liter); $CaCO_3$, 113 mg/L; pH, 7.1.



REFERENCE: Flippo, H. N., Jr. (1974), *Springs of Pennsylvania,* Pennsylvania Department of Environmental Resources, Office of Resources Management, Water Resources Bulletin 10, 46 p.

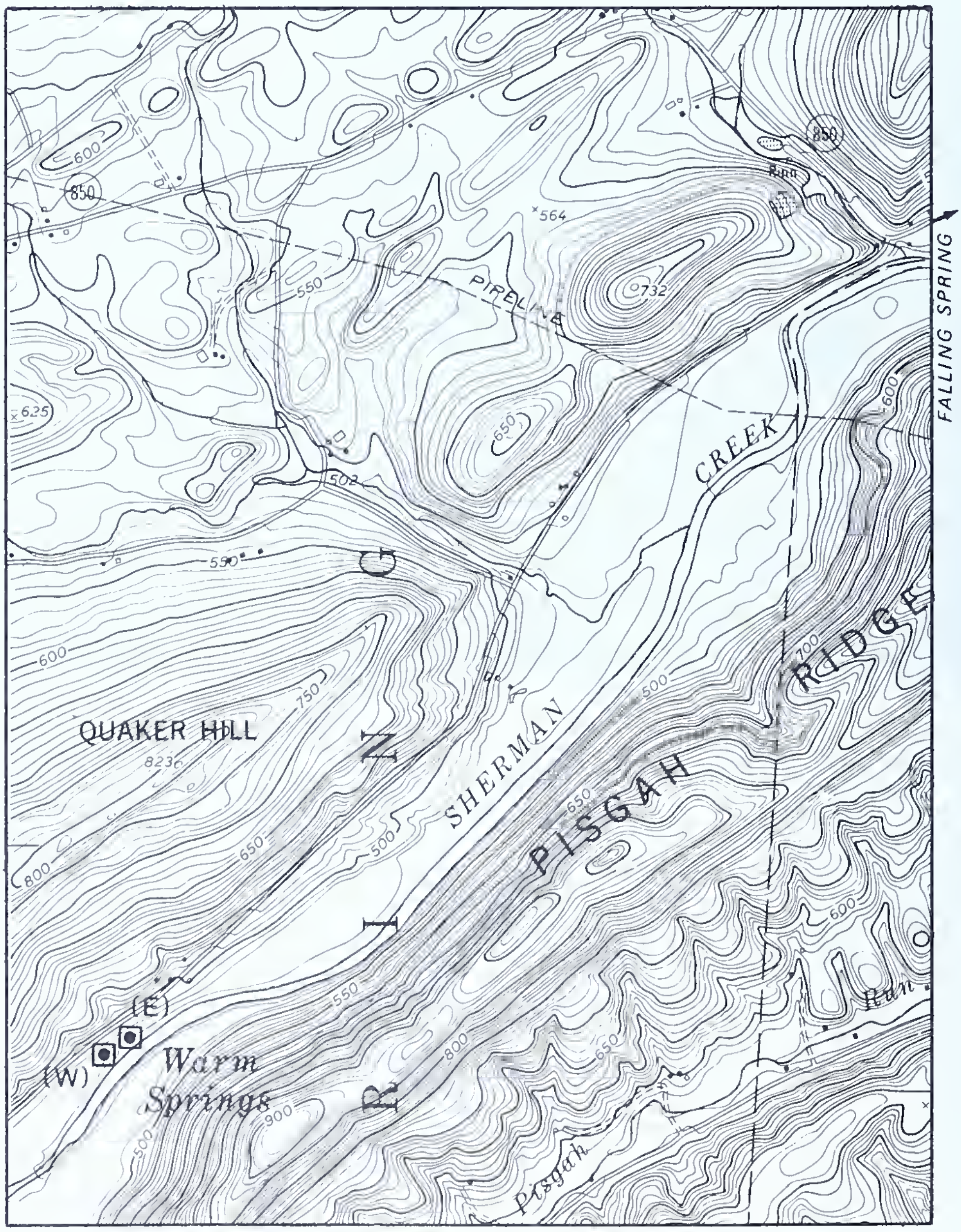
NOTES:

# 486. WARM SPRINGS

COUNTY: Perry TOWNSHIP: Spring

QUADRANGLE: Shermans Dale

LOCATION: Approximately 2.4 miles west of Falling Spring along Sherman Creek; site of an old hotel by the same name.



REMARKS: The aquifer is the Oriskany Sandstone. There are three separate springs—east, middle, and west. Temperature measurements are as follows:

| *Date* | *Measured by* | *Spring* | *Temperature* |
|---|---|---|---|
| 10-27-1883 | E. W. Claypole | East | 65°F |
| | | Middle | 61°F |
| | | West | 60°F |
| 6- 4-1942 | R. M. Foose | East | 18°C/ 64.4°F |
| | | West | 17°C/ 62.6°F |
| 6-13-1942 | R. W. Stone | East | 19°C/ 66.2°F |
| 11-19-1982 | D. W. Royer | East | 17.9°C |
| | | West | 15.5°C |

Warm springs are rare in Pennsylvania, and these are the warmest reported to date.

EAST SPRING
WARM

## 486. WARM SPRINGS *(continued)*

REFERENCES: Claypole, E. W. (1885), *A preliminary report on the palaeontology of Perry County describing the order and thickness of its formations and its folded and faulted structure,* Pennsylvania Geological Survey, 2nd ser., Report F2, p. 347-348.

WEST SPRING
WARM

Hobba, W. A., Jr., Fisher, D. W., Pearson, F. J., Jr., and Chemerys, J. C. (1979), *Hydrology and geochemistry of thermal springs of the Appalachians,* U.S. Geological Survey Professional Paper 1044-E, p. E1–E36.

Royer, D. W. (1984), *Summary groundwater resources of Perry County, Pennsylvania,* Pennsylvania Geological Survey, 4th ser., Water Resource Report 59, 70 p.

Stone, R. W. (1942), *So-called "warm" springs in Pennsylvania,* Pennsylvania Department of Internal Affairs Monthly Bulletin, v. 10, no. 8, p. 8–12.

______ (1942), *Huntingdon "Warm Springs" in pioneer days,* Pennsylvania Department of Internal Affairs Monthly Bulletin, v. 10, no. 9, p. 18–21.

FAR WEST SPRING
NORMAL (NOT WARM)

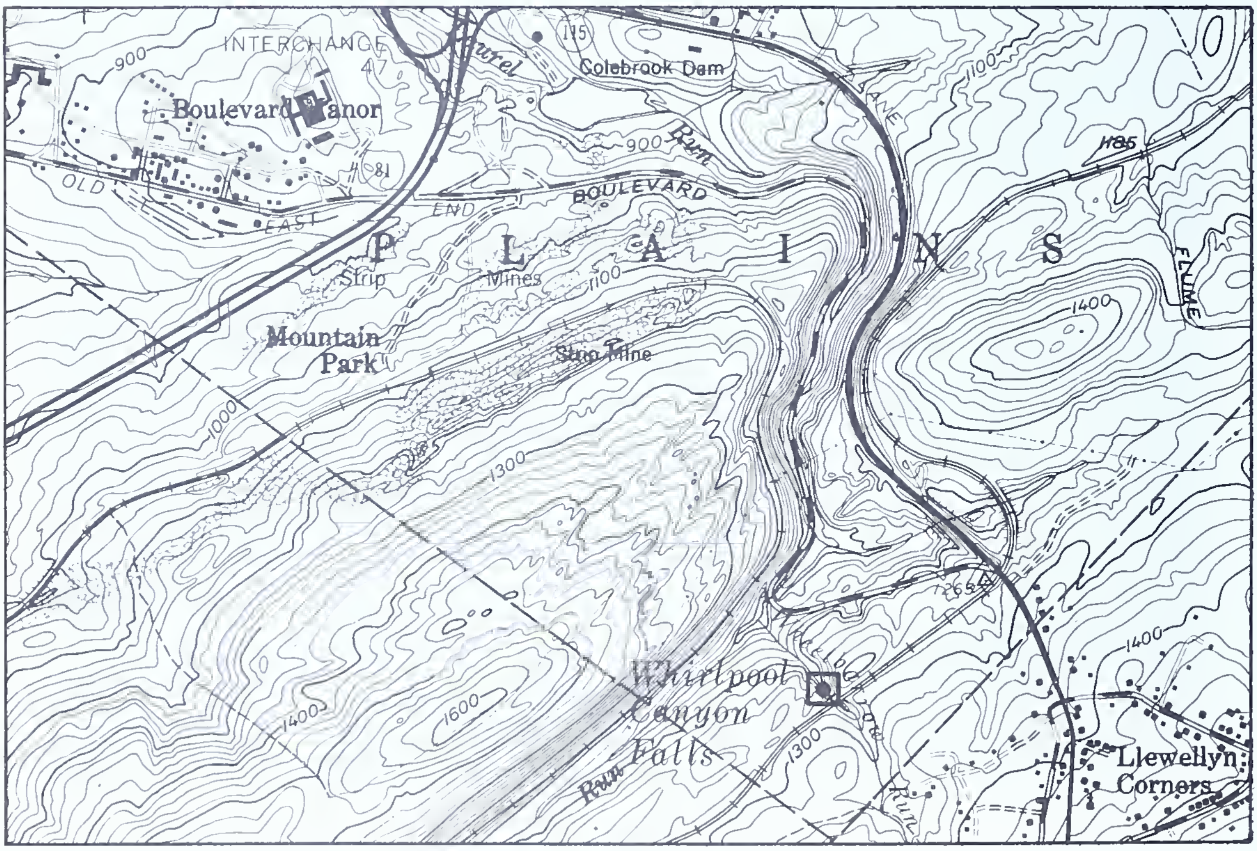
# 487. WHIRLPOOL CANYON FALLS

COUNTY: Luzerne TOWNSHIP: Plains

QUADRANGLE: Wilkes-Barre East

LOCATION: Along Wheelbarrow Run, about 900 feet south of Old East End Boulevard, 0.35 mile west of Pa. Route 115, and 1.2 miles southeast of interchange 47 of Interstate Route 81.

REMARKS: **Whirlpool Canyon** (EG 7, Part 1, site 281) contains a series of falls over sandstone and conglomerate of the Pocono Formation (Mississippian age). The canyon may have been formed during the Pleistocene Epoch (10,000 years ago) when a meltwater stream flowing through the glacier plunged over the edge of the ice or over an ice cliff within the glacier.



REFERENCE: Bohlin, Annie (1978), personal communication, Wilkes-Barre, Pa.

# 488. WHITE SULPHUR SPRING

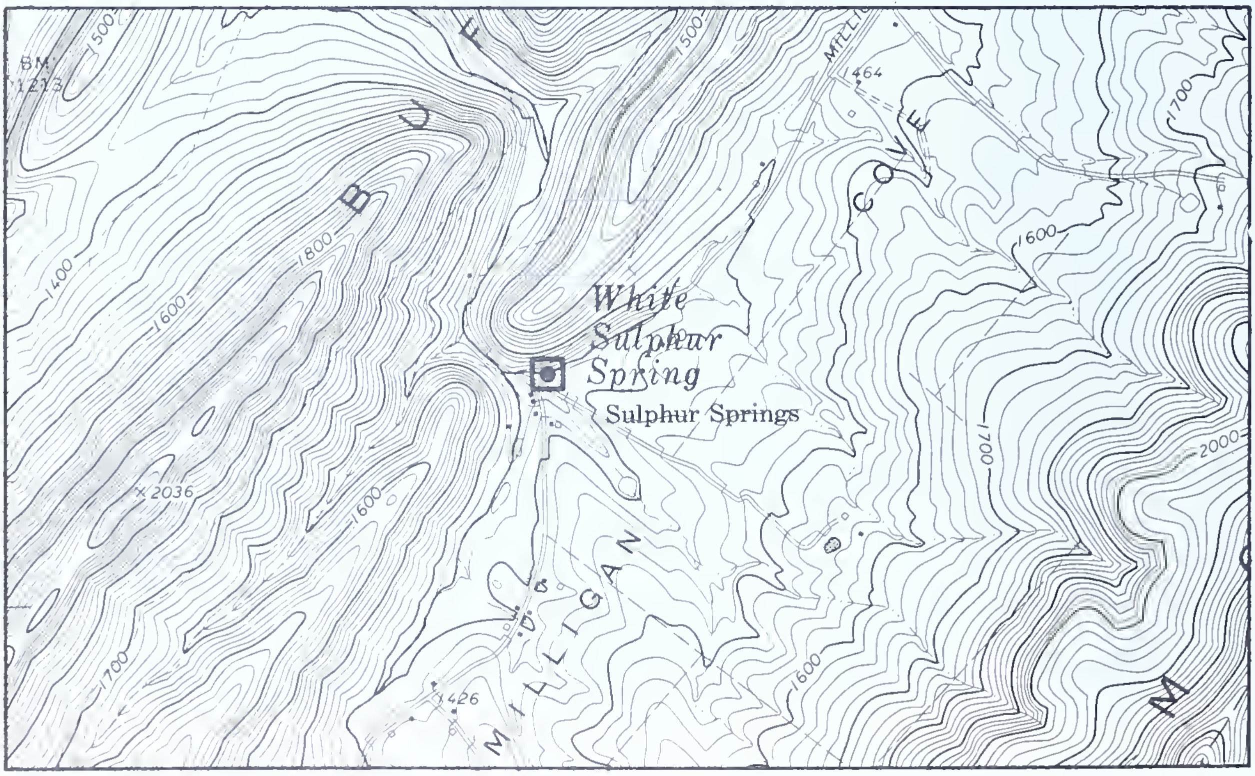
COUNTY: Bedford TOWNSHIP: Harrison

QUADRANGLE: Rainsburg

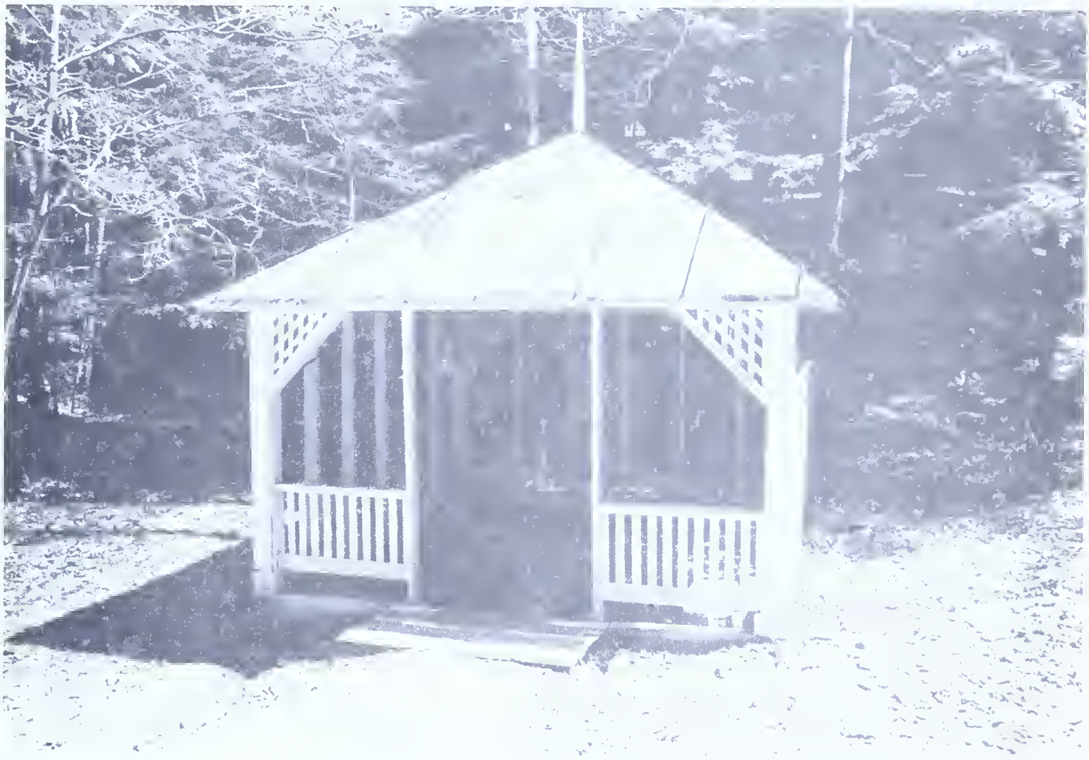
LOCATION: In Milligan Cove at the southeastern end of the gap in Buffalo Mountain; on the grounds of the White Sulphur Spring Hotel (dates to 1886), along a beautiful nature trail.

REMARKS: In 1881 this spring served two small hotels and was known as the **Reed and Lyon White Sulphur Spring.** The estimated yield (April 1984) is about 1 gallon per minute from shale of the Reedsville Formation (Ordovician age). The spring has a strong hydrogen sulfide odor. It is one of Pennsylvania's famous mineral springs.

REFERENCES: Flippo, H. N., Jr. (1974), *Springs of Pennsylvania,* Pennsylvania Department of Environmental Resources, Office of Resources Management, Water Resources Bulletin 10, 46 p.



Stevenson, J. J. (1882), *The geology of Bedford and Fulton Counties,* Pennsylvania Geological Survey, 2nd ser., Report T2, p. 343–344.



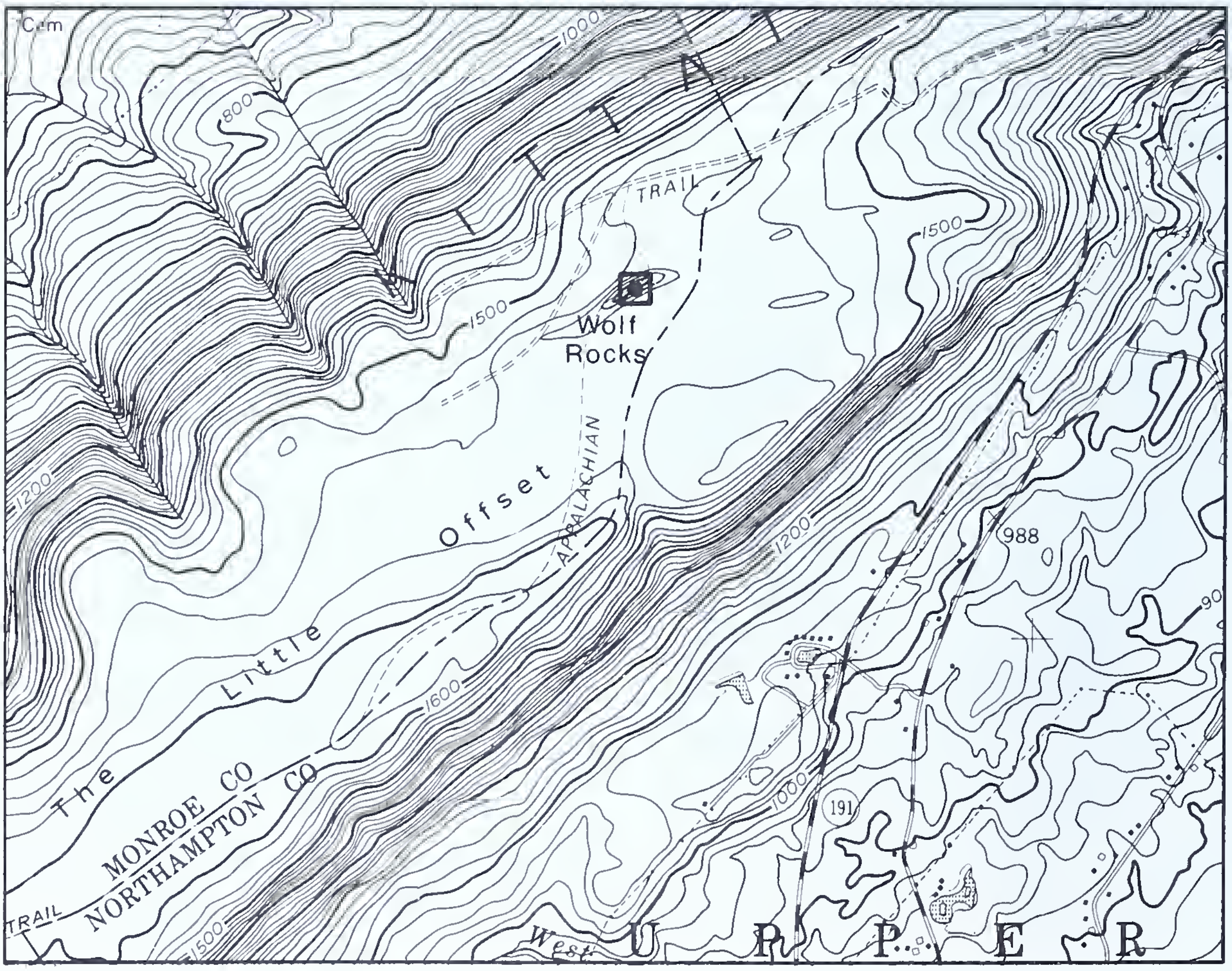
## 489. WOLF ROCKS

COUNTY: Monroe TOWNSHIP: Hamilton

QUADRANGLE: Stroudsburg

LOCATION: On the Appalachian Trail at The Little Offset on Kittatinny Mountain, about 6 miles southwest of the Delaware Water Gap.

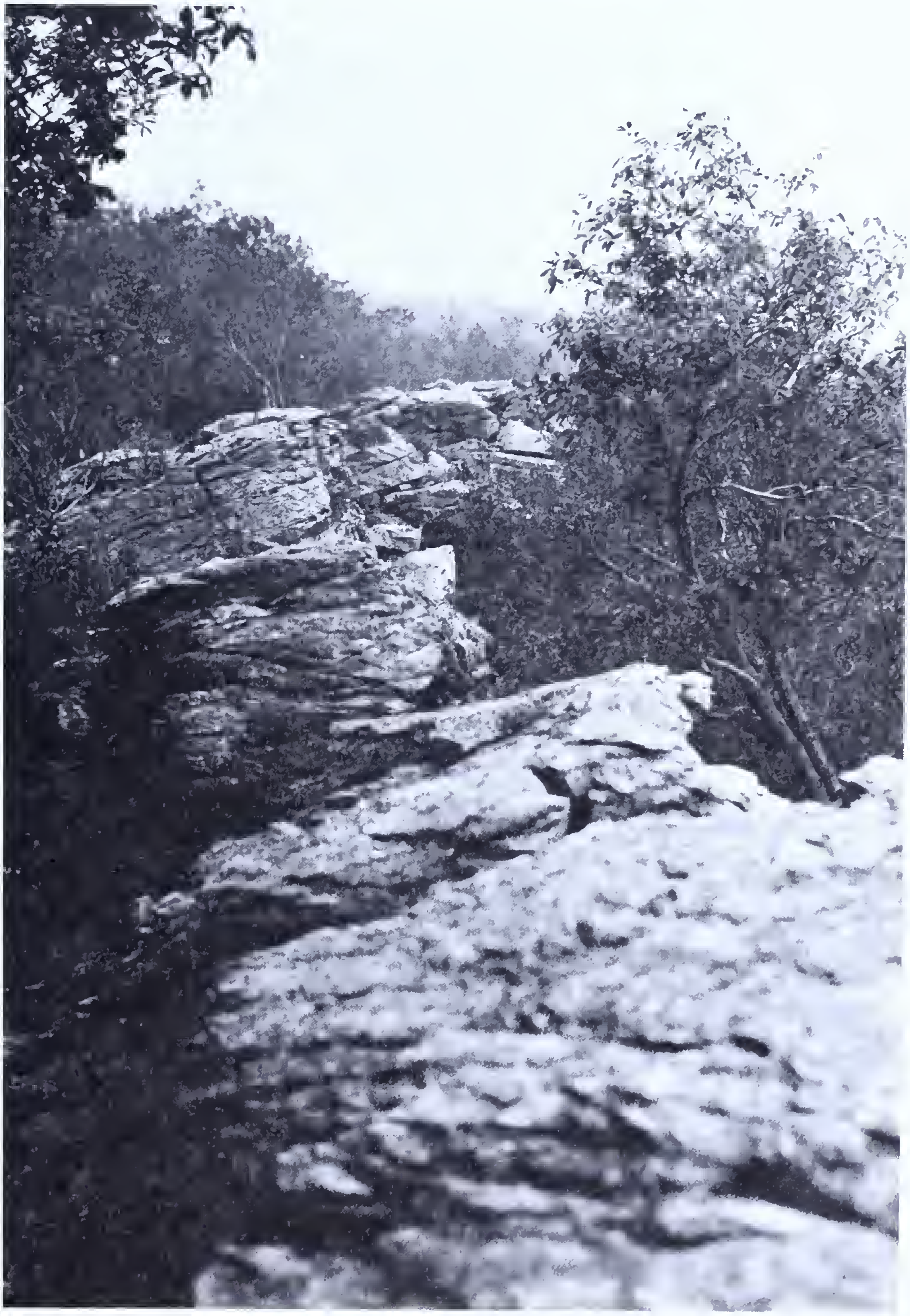
REMARKS: Wolf Rocks has been called the most outstanding viewpoint from the Appalachian Trail in eastern Pennsylvania. The rock here is quartzite (Shawangunk Formation, Silurian age). It underlies The Little Offset ridge and crops out in a narrow band of bare rock. Wolf Rocks marks the southernmost point of continental glaciation along the Trail; the effects of the glacial climate extended far to the south, but the ice stopped here.



VALLEY AND RIDGE PROVINCE

APPALACHIAN MOUNTAIN SECTION

REFERENCE: Wilshusen, J. P. (1983), *Geology of the Appalachian Trail in Pennsylvania,* Pennsylvania Geological Survey, 4th ser., General Geology Report 74, 121 p.



(Photograph by J. P. Wilshusen)

## 490. YODER SPRING

COUNTY: Mifflin TOWNSHIP: Brown

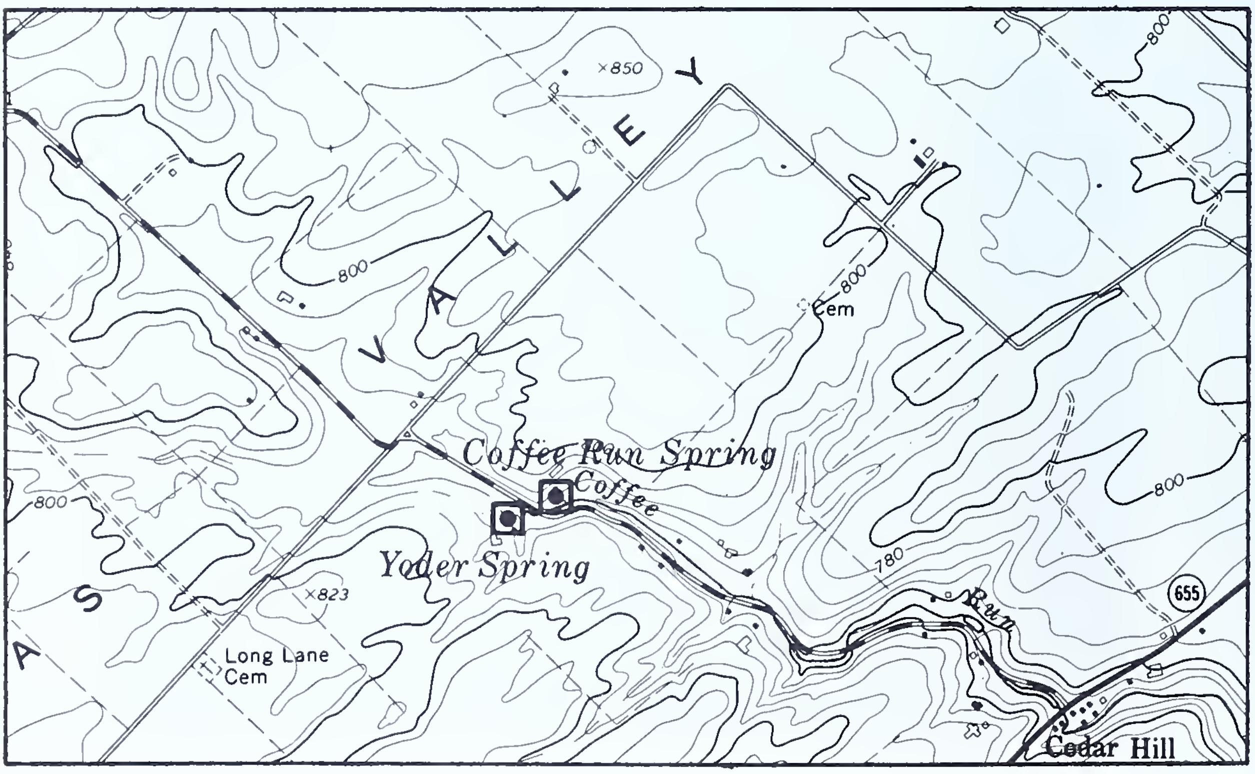
QUADRANGLE: Barrville

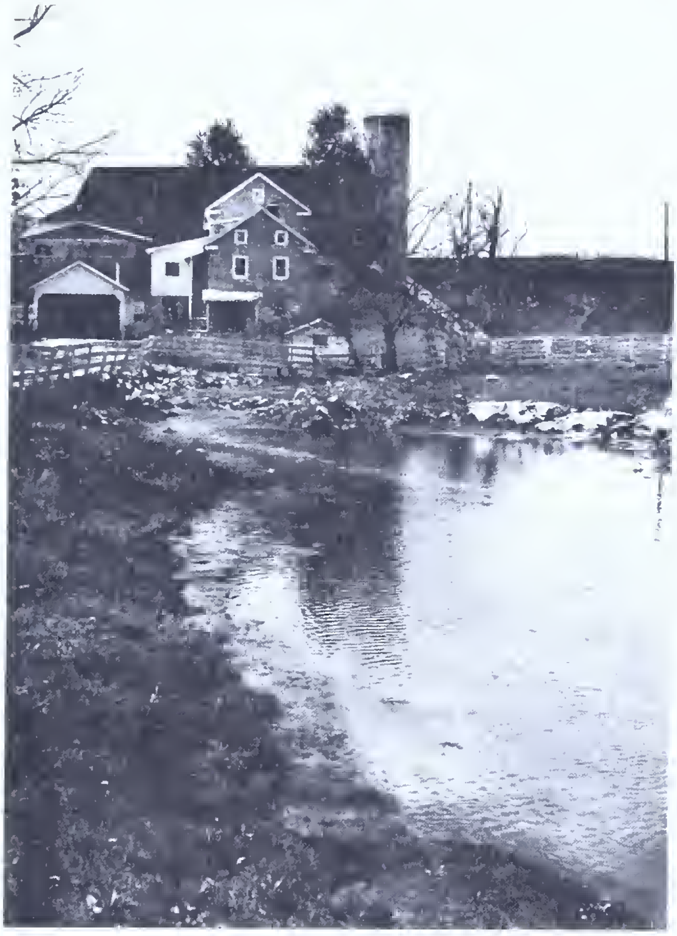
LOCATION: At the head of Coffee Run, 0.95 mile northwest of the village of Cedar Hill and Pa. Route 655.

REMARKS: Two large springs issue from the limestone and dolomite of the Axemann Formation (Ordovician age). Yoder Spring had a measured yield (November 8, 1971) of 1,230 gallons per minute. Nearby **Coffee Run Spring** (491) measured slightly less.

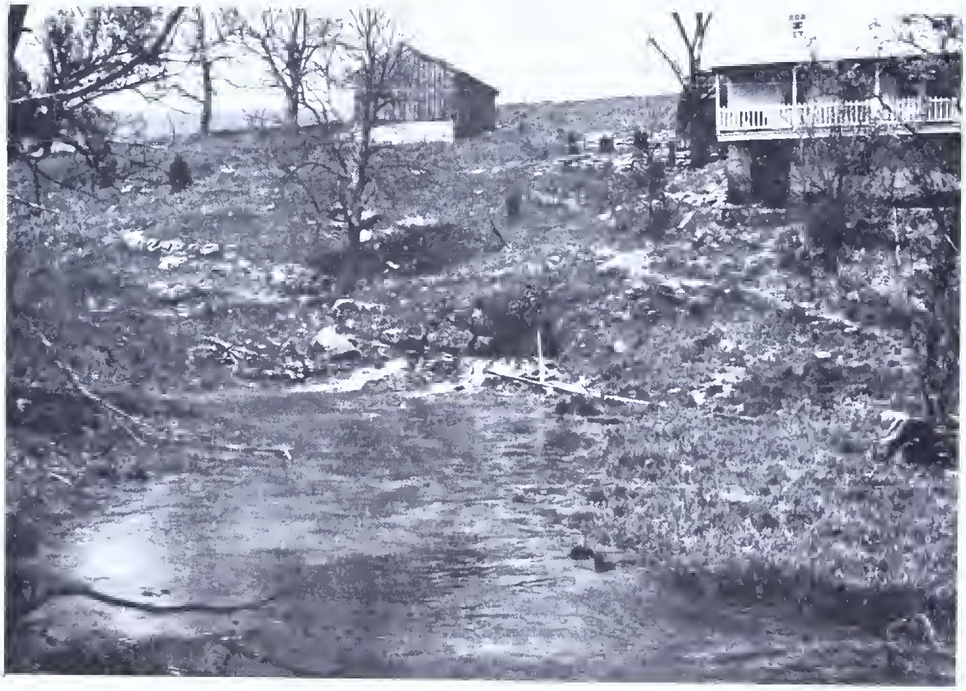
CHEMISTRY: Temperature, 10.5°C; Ca, 55 mg/L (milligrams per liter); Mg, 14 mg/L; Na, 5.8 mg/L; $HCO_3$, 148 mg/L; $SO_4$, 13 mg/L; Cl, 40 mg/L; $NO_3$, 20 mg/L; $PO_4$, 0.03 mg/L; $CaCO_3$, 195 mg/L; specific conductance, 392; pH, 7.3–7.7.

REFERENCE: Flippo, H. N., Jr. (1974), *Springs of Pennsylvania,* Pennsylvania Department of Environmental Resources, Office of Resources Management, Water Resources Bulletin 10, 46 p.





YODER SPRING



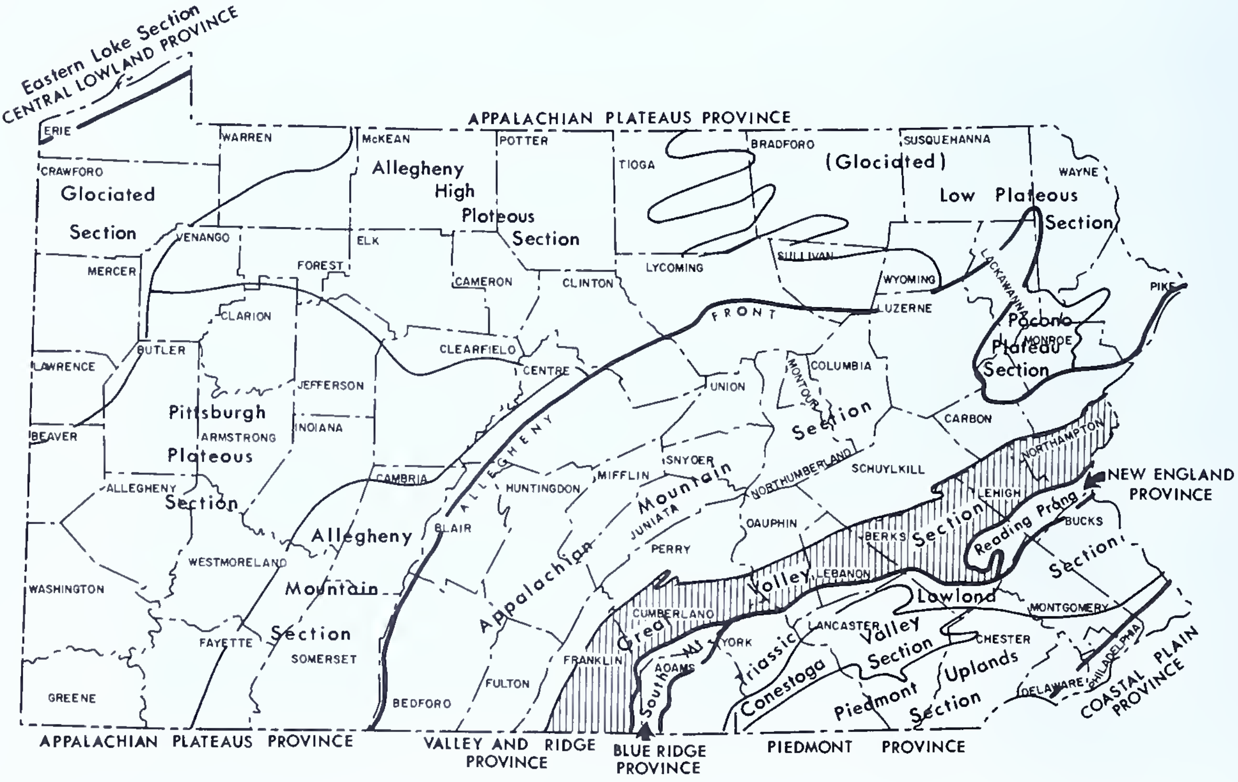
COFFEE RUN SPRING

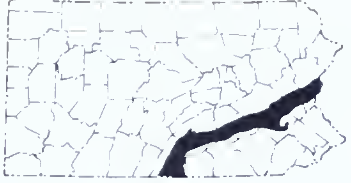
# VALLEY AND RIDGE PROVINCE— GREAT VALLEY SECTION

## *TOPOGRAPHY*

The Great Valley section derives its name from the fact that it is an almost continuous valley from New York to Georgia. In south-central Pennsylvania it is called the Cumberland Valley, whereas to the north and east it is known as the Lebanon Valley and farther east as the Lehigh Valley. In Maryland it is known as the Hagerstown Valley and in Virginia, the famous Shenandoah Valley.

The Great Valley can be divided both topographically and geologically into two belts: (1) The area that borders the Appalachian Mountain section is underlain by Ordovician shales, siltstones, and sandy beds characterized by rolling hills and well-developed drainage. Large permanent streams are generally restricted to this shale area and meander in small steep-walled valleys. The shale terrain is 100 to 150 feet higher than the adjacent limestone due to its greater resistance to erosion. (2) Moving away from the shale boundary the rocks of the valley that form the second belt are Cambrian and Ordovician limestones and dolomites that result in a low, flat, gently rolling terrain; the low relief is due entirely to the solubility of the thick se-





quence of carbonate rocks. Disappearing streams, sinkholes, and caves are typical karst topographic features. A thick soil cover makes the valley very fertile, and large, prosperous farms are abundant. The rock sequence generally becomes successively younger as the boundary of the Appalachian Mountain section is approached.

## *ROCK COLUMN*

With the exception of isolated, discontinuous diabase dikes of Triassic and Jurassic ages, the exposed bedrock of the Great Valley is sedimentary in origin and from Cambrian to Late Ordovician in age. Some surficial deposits occur as alluvium in stream valleys and as colluvium 200 to 300 feet thick along the margins of Blue Mountain and South Mountain. The thickness of the carbonate rock sequence is about 13,000 feet.

| SYSTEM | ROCK UNIT | DESCRIPTION |
|---|---|---|
| CUMBERLAND VALLEY SEQUENCE: | | |
| Ordovician | Martinsburg Formation | Black shale; weathers buff. |
| | Chambersburg Formation | Dark-gray cobbly limestone. |
| | St. Paul Group | Fossiliferous limestone, black chert, and dolomite. |
| | Beekmantown Group | |
| | Pinesburg Station Formation | Light-colored thick-bedded dolomite; includes some limestone. |
| | Rockdale Run Formation | Mostly limestone; some dolomite; some chert; at base, 500 feet of pinkish limestone and chert. |
| | Stonehenge Formation | Fossiliferous limestone. |
| | Stoufferstown Formation | Coarse limestone containing dark-gray siliceous seams; prominent ridge former. |
| Cambrian | Conococheague Group | |
| | Shadygrove Formation | Pure, light-colored limestone; abundant pinkish limestone and cream-colored chert. |
| | Zullinger Formation | Interbanded limestone and dolomite; several thin local quartz sand beds. |
| | Elbrook Formation | Light-colored limy shale and silty limestone; blue limestone and dolomite; pure, dark limestone at base. |
| | Waynesboro Formation | Thin red sandy limestone; middle portion is blue limestone. |
| | Tomstown Dolomite | Dolomitic limestone; silty dolomite in middle part. |
| LEBANON VALLEY SEQUENCE: | | |
| Ordovician | Martinsburg Formation | Light-gray shale, sandstone, red shale, and interbedded gray shale and platy limestone. |
| | Hershey Limestone | Dark-gray thin-bedded limestone. |
| | Myerstown Limestone | Gray thin-bedded limestone; black graphitic limestone at base. |
| | Annville Limestone | Light-gray limestone; high calcium (pure); massive bedded. |

| SYSTEM | ROCK UNIT | DESCRIPTION |
|---|---|---|
| Ordovician | Beekmantown Group | |
| | Ontelaunee Formation | Medium-gray massive-bedded dolomite; chert at base. |
| | Epler Formation | Medium-gray limestone interbedded with dolomite; cherty; fossiliferous. |
| | Rickenbach Formation | Medium-gray dolomite, cherty, sandy. |
| | Stonehenge Formation | Gray limestone, cherty; thin shaly beds; "flat-pebble" breccia beds. |
| Cambrian | Conococheague Group | |
| | Richland Formation | Medium-gray dolomite, cherty, oolitic, sandy; some "flat-pebble" breccia beds. |
| | Millbach Formation | Pinkish-colored limestone, oolitic; cryptozoon reefs; interbedded dolomite. |
| | Schaefferstown Formation | Medium-gray thin-bedded limestone. |
| | Snitz Creek Formation | Medium-gray dolomite, sandy, cherty. |
| | Buffalo Springs Formation | Pinkish-gray limestone; cryptozoon reefs; sandy; interbedded dolomite. |
| | Tomstown Formation | Massive dolomite, sandy. |
| LEHIGH VALLEY SEQUENCE: | | |
| Ordovician | Martinsburg Formation | |
| | Pen Argyl Member | Thick-bedded dark-gray slate. |
| | Ramseyburg Member | Interbedded sequence of dark-gray thick-bedded graywacke and siltstone. |
| | Bushkill Member | Thin-bedded dark-gray slate. Unit contains minor thin beds of siltstone, black slate, and dolomitic siltstone. |
| | Jacksonburg Formation | Dark-gray thin-bedded silty limestone; medium-gray high-calcium (pure) limestone. |
| | Beekmantown Group | Dark-gray dolomite and some interbedded limestone containing nodules and lenses of chert. |
| Cambrian | Allentown Formation | Light-gray dolomite and some interbedded limestone. Formation is characterized by alternating light and dark beds. |
| | Leithsville Formation | Dark-gray buff-weathering dolomitic limestone and limy shale, in places phyllite. Occurs on or near the flanks of South Mountain. |

## *ROCK STRUCTURE*

The geologic structure of the Great Valley is varied and complex. Variations and generalizations may be best described from Franklin County, in south-central Pennsylvania, north and east to Northampton County and the Delaware River.

In Franklin County the Cumberland Valley limestones are part of the South Mountain anticlinorium and were involved in the related folding and faulting with the Catoctin greenstones of South Mountain. Most major faults are high-angle reverse faults; some are traceable for more than 30 miles.

Although the structural geology is complex, it is extremely regular and maintains this regularity north to the Lebanon Valley.

The main structural feature in the rocks of the Lebanon Valley is a large overturned fold upon which are imposed minor local folds. This fold system extends about 60 miles along strike and is about 11 miles wide near Lebanon, where a maximum rock thickness is exposed.

The structure of the rocks east of the Lebanon Valley (from Womelsdorf to the Delaware River) is the result of several periods of folding and thrust faulting related to both the Taconic orogeny (Late Ordovician) and the Alleghanian orogeny (Late Paleozoic).

# 492. BIG SPRING

COUNTY: Franklin TOWNSHIP: Washington

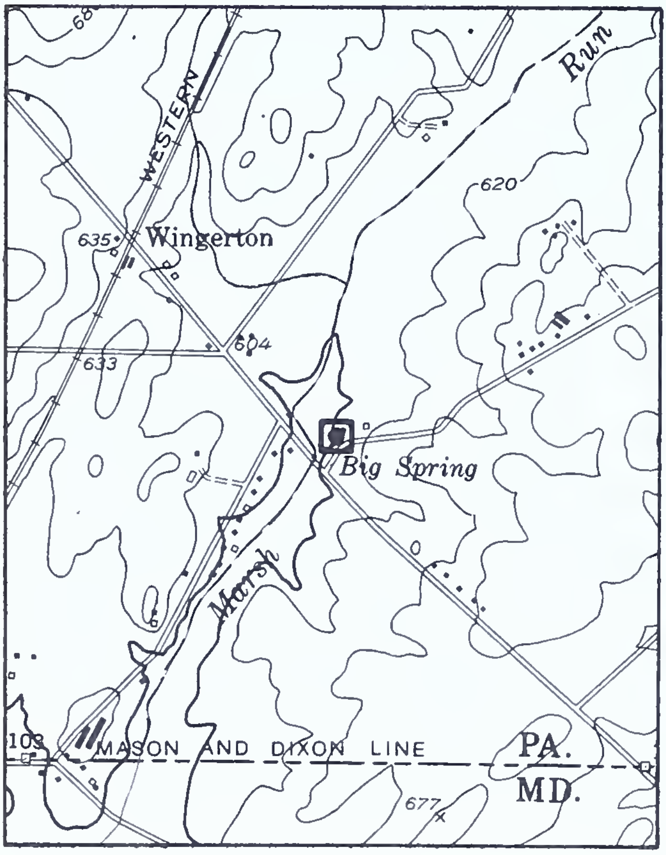
QUADRANGLE: Hagerstown, Maryland-Pennsylvania

LOCATION: Along Marsh Run, 0.55 mile north of the Mason and Dixon Line.

REMARKS: The measured flow of Big Spring, which is currently unused, is 2,500 gallons per minute (June 22, 1979). It is a fault-contact spring at the contact between limestone of the Shadygrove Formation and limestone of the Stoufferstown Formation.

CHEMISTRY: Electrical conductivity, 625 micromhos; hardness, 13 grains per gallon.

REFERENCE: Becher, A. E., and Taylor, L. E. (1982), *Groundwater resources in the Cumberland and contiguous valleys of Franklin County, Pennsylvania,* Pennsylvania Geological Survey, 4th ser., Water Resource Report 53, p. 67.



# 493. SCHAEFFERSTOWN (WALNUT) SPRING

COUNTY: Lebanon BOROUGH: Schaefferstown

QUADRANGLE: Richland

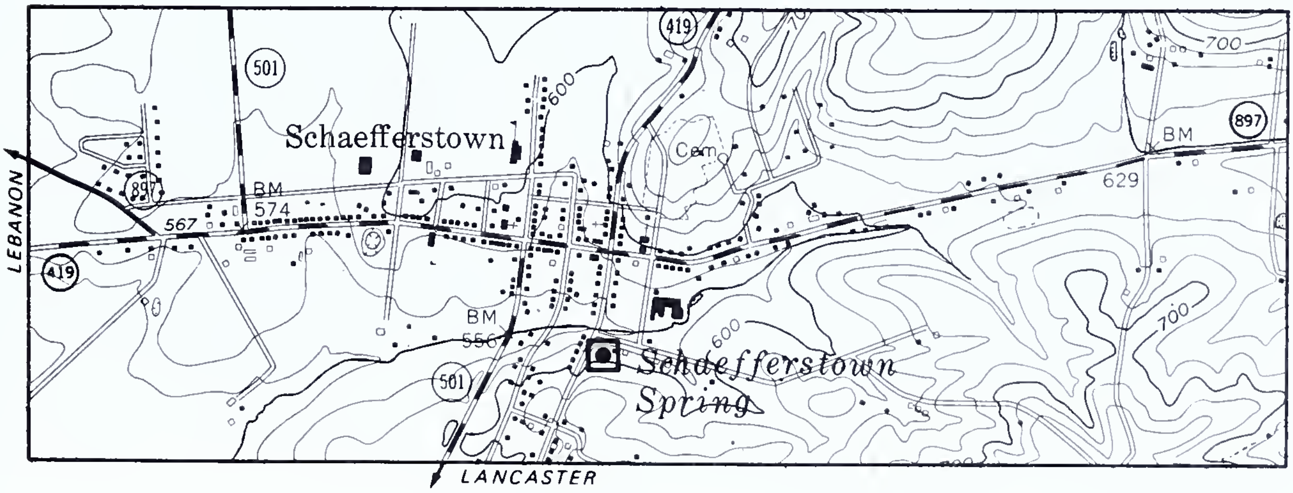
LOCATION: Along south Market Street in the borough of Schaefferstown, which is about 7.5 miles southeast of Lebanon and 17 miles north of Lancaster.

REMARKS: Schaefferstown Spring issues from the limestone conglomerate of the Hammer Creek Formation (Triassic age). The yield is usually less than 10 gallons per minute. This spring was deeded from Alexander Schaeffer to the residents of Market Street on July 16, 1763. The water is now piped from the spring to a fountain near the spring and to two fountains on Market Street. The water flows by gravity from the spring in Fountain Park to the fountains.

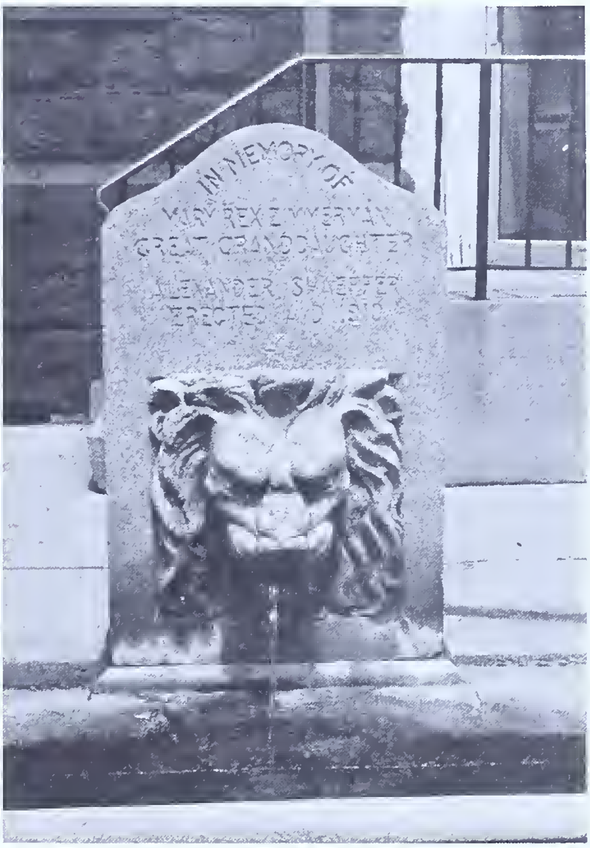
It is the oldest chartered waterworks in the United States.

REFERENCES: Gray, Carlyle, Geyer, A. R., and McLaughlin, D. B. (1958), *Geology of the Richland quadrangle,* Pennsylvania Geological Survey, 4th ser., Atlas 167, scale 1:24,000.

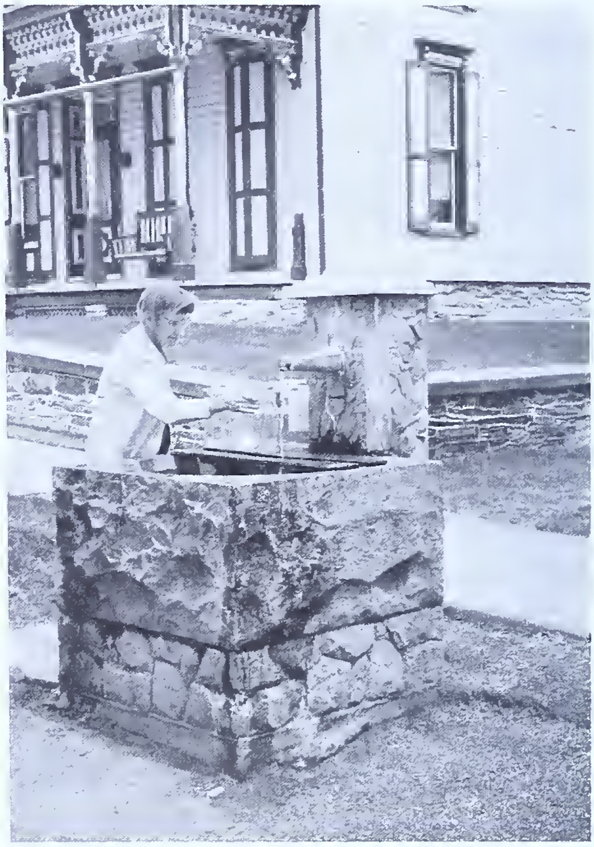
Thomas R. Brendle Museum of Historic Schaefferstown, Inc., Schaefferstown, Pa.



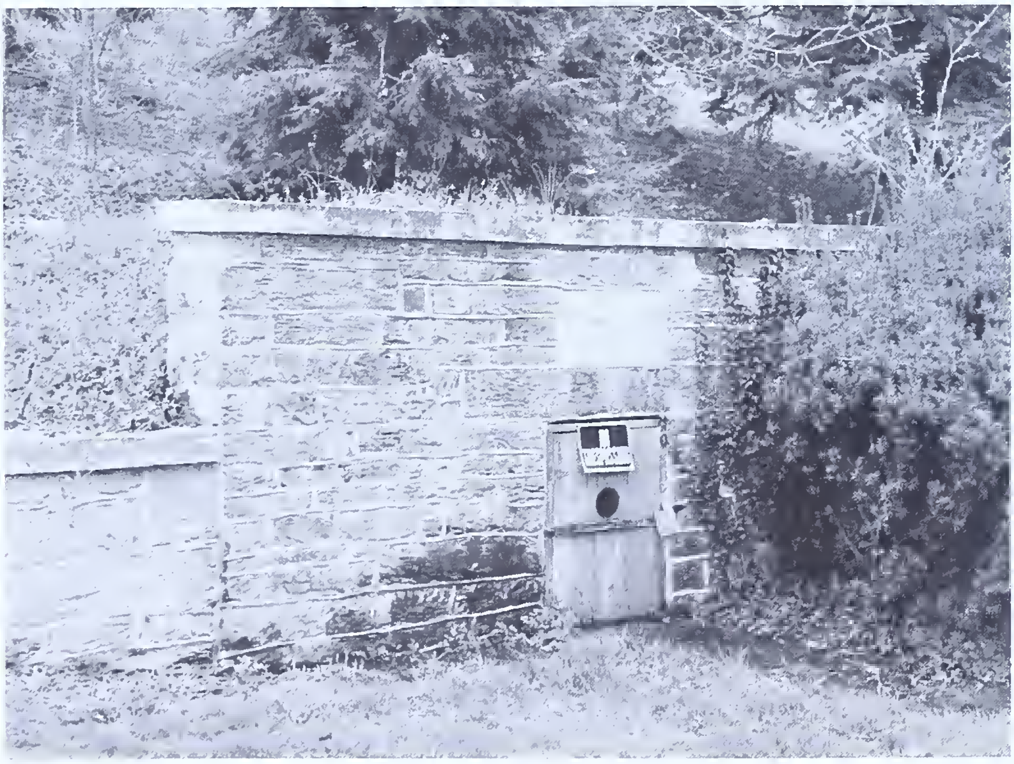
## 493. SCHAEFFERSTOWN (WALNUT) SPRING *(continued)*



FOUNTAIN IN SQUARE



FOUNTAIN ALONG MARKET STREET



SPRING HOUSE IN FOUNTAIN PARK

VALLEY AND RIDGE PROVINCE

GREAT VALLEY SECTION

# 494. SPRING CREEK (DERRY) SPRINGS

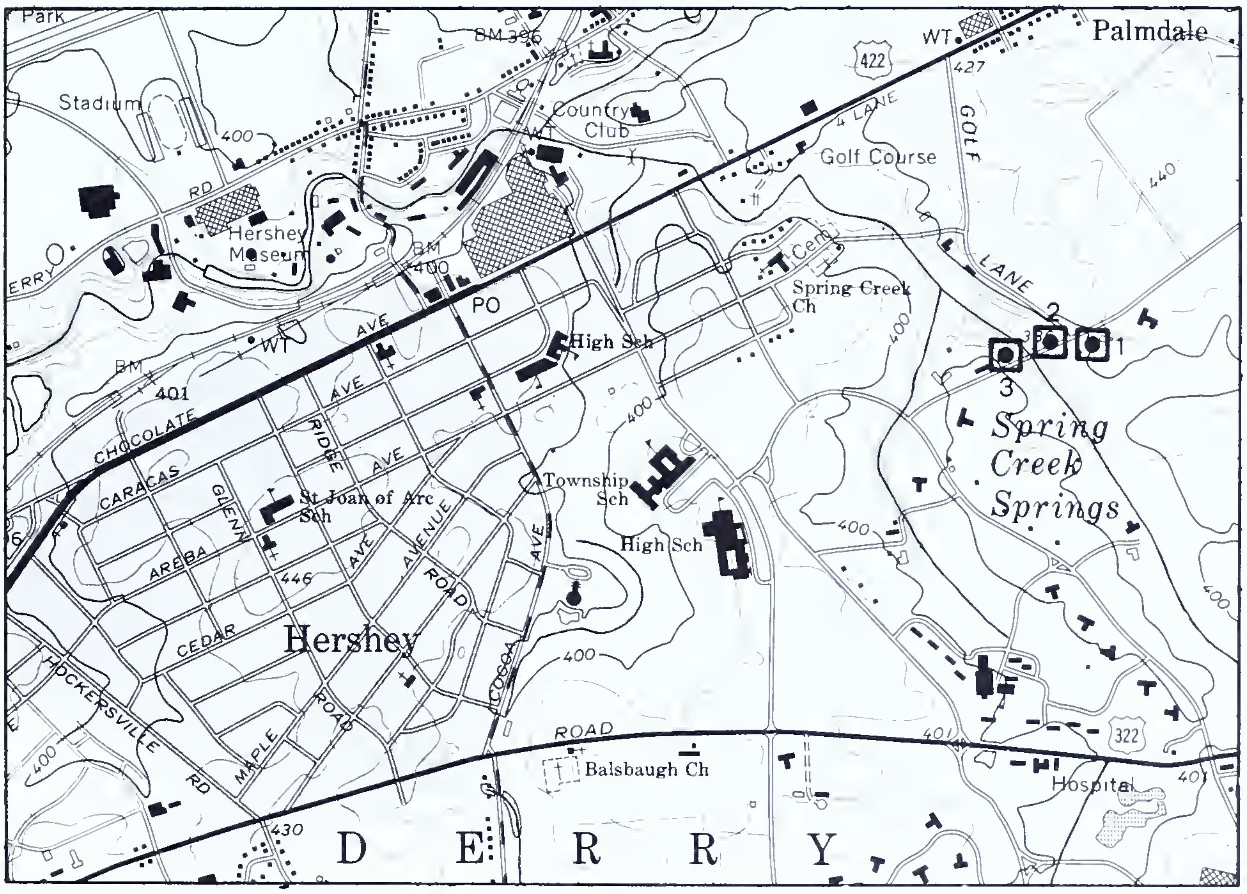
COUNTY: Dauphin — TOWNSHIP: Derry

QUADRANGLE: Hershey

LOCATION: Approximately 2,600 feet southeast of Spring Creek Church, at the intersection of Golf Lane and "Bloomingdale" student home (Milton Hershey School).

REMARKS: Three large springs have a combined flow of more than 10,000 gallons per minute (estimated March 15, 1984). Springs 1 and 2 are boiling springs and are being utilized for a cooperative fish culture facility operated by the Pennsylvania Fish Commission and the Quittapahilla Rod and Gun Club.

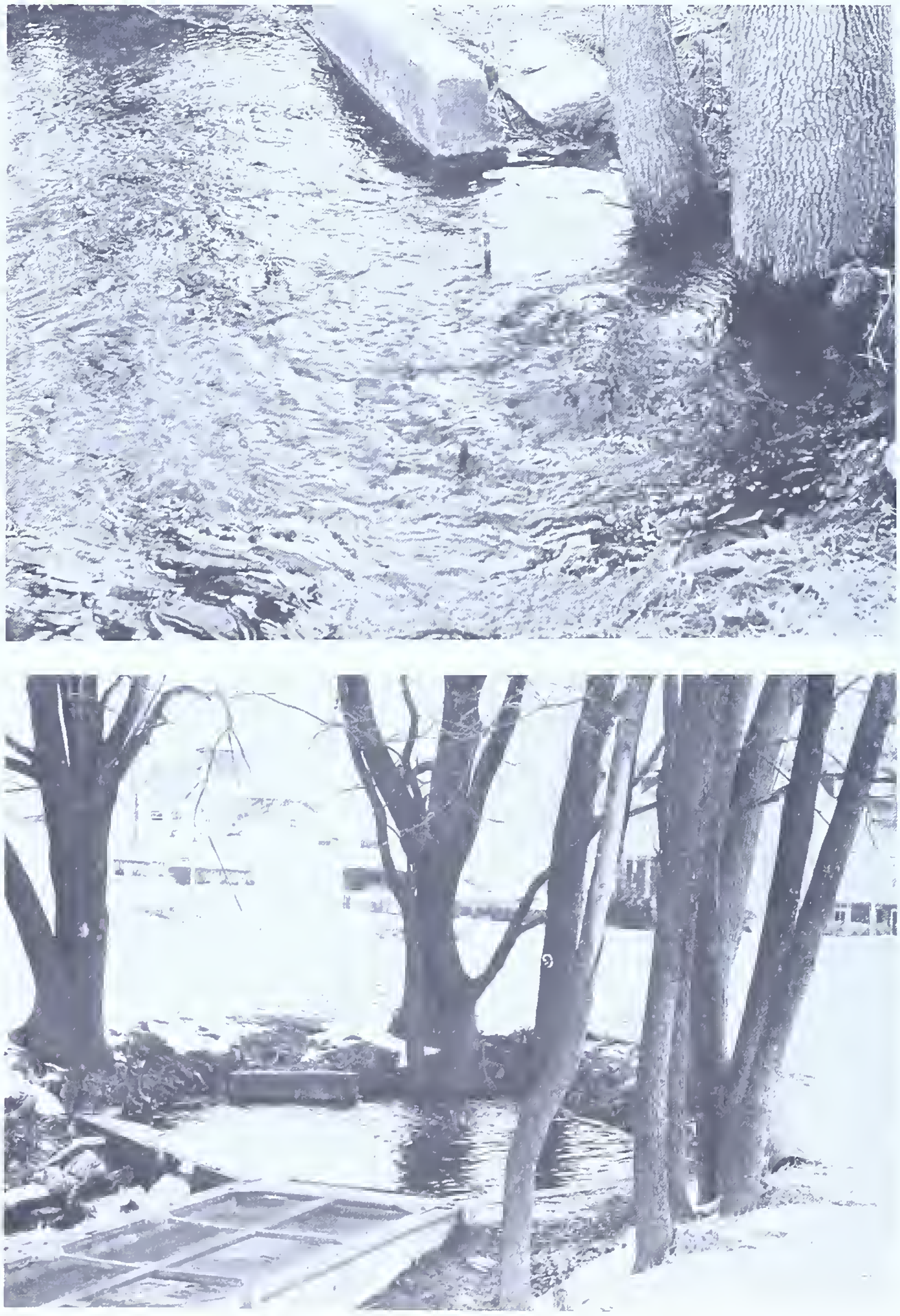
The interbedded limestone and dolomite of the Epler Formation (Ordovician age) is the aquifer. This



## 494. SPRING CREEK (DERRY) SPRINGS *(continued)*

rock unit is noted for large solution cavities, caves, and sinkholes in the overlying soil cover.

These are springs of second-order magnitude, which are very rare in Pennsylvania. Their name was derived from the name of the village, Spring Creek, in 1878. By 1890 the town was called Derry, and it became known as Hershey in the early 1900's.



SPRING 2

# BLUE RIDGE PROVINCE—SOUTH MOUNTAIN SECTION

## *TOPOGRAPHY*

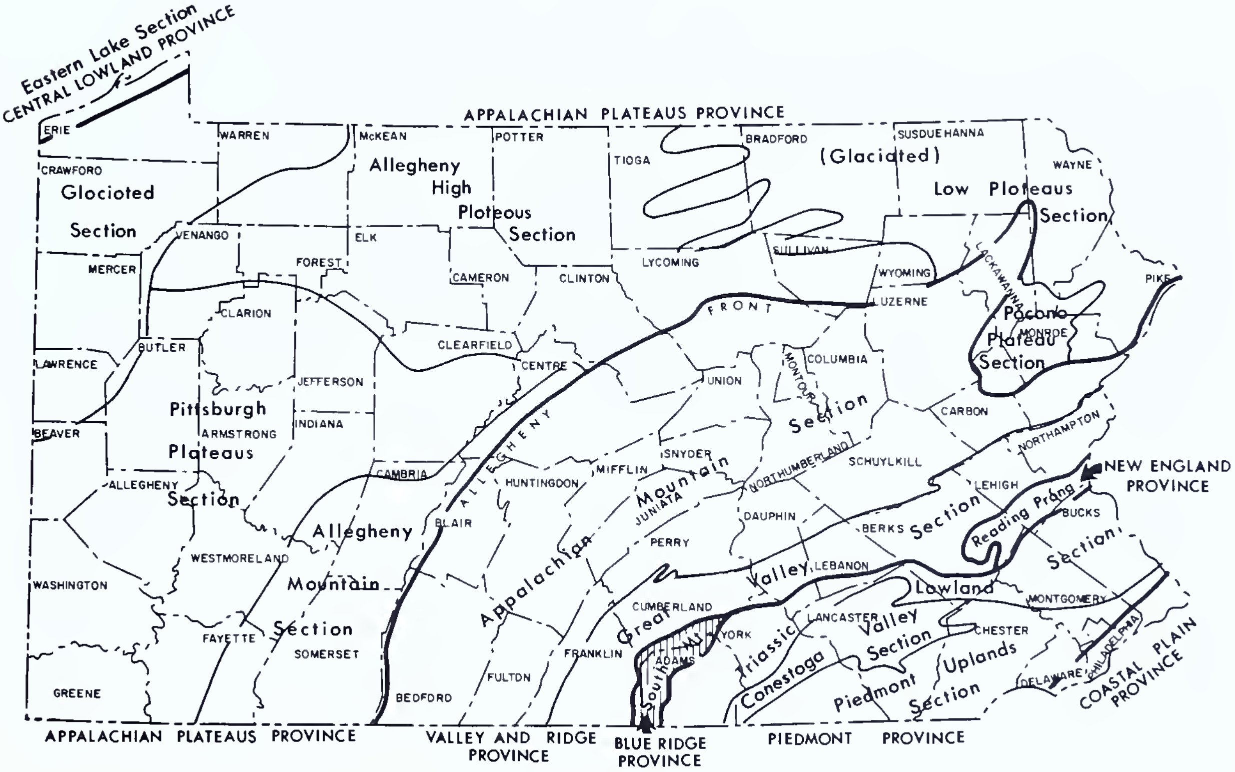
The Blue Ridge province is bounded on the west by the Great Valley section of the Valley and Ridge province and on the east primarily by the Triassic Lowland section of the Piedmont province.

Mountaintop elevations range from 1,500 feet above sea level near Mount Holly Springs to 2,100 feet atop Big Pine Flat Ridge north of Caledonia Park. The lowest elevation is 675 feet, and the maximum relief is about 1,425 feet.

A series of northeast-trending ridges of South Mountain dominate the topography. Individual ridges are separated by narrow valleys. Because many of the ridges have almost flat-topped summits and concordant summit levels, they form a broad, moderately dissected upland surface.

Slopes average 8 to 15 degrees, but slopes of 20 to 30 degrees are not uncommon along the flanks of the deep, V-shaped stream valleys.

Stream gradients vary widely throughout the area. Gradients of 300 to 400 feet per mile are typical of the mountain streams, whereas gradients of 100 to 170 feet per mile are common elsewhere.



## ROCK COLUMN

The Catoctin Formation is a thick sequence of volcanic rocks, rhyolites, and basalts. A thick section of clastic rocks overlies the volcanic rocks. These rocks, called the Chilhowee Group, include the Loudoun, Weverton, Harpers, and Antietam Formations. This group is assigned an Early Cambrian age because its upper part (Antietam Formation) contains Lower Cambrian fossils. A description of the rocks follows:

| SYSTEM | ROCK UNIT | DESCRIPTION |
|---|---|---|
| Cambrian | Waynesboro Formation | Buff dolomite, dark-blue limestone, dark-red to purple, sandy shale and siltstone, and subordinate light-colored sandstone. |
| | Tomstown Formation | Dolomite and dolomitic limestone. |
| | Chilhowee Group | |
| | Antietam Formation | White to gray, medium- to coarse-grained sandstone and quartzite. |
| | Harpers Formation<br>Montalto Member | Greenish-gray fine-grained quartzose graywacke, sandstone, and quartzite. |
| | Weverton Formation | Interbedded series of gray-green and purplish sandstone and quartzose graywacke. |
| | Loudoun Formation | Conglomerate member is grayish-green graywacke and quartz-phyllite-rhyolite-pebble conglomerate. Phyllite member is predominantly reddish purple and has greenish or white blebs or streaks. |
| Precambrian | Catoctin Formation | |
| | Metarhyolite | Blue, red, and gray, fine-grained metarhyolite. Red to lavender, porphyritic metarhyolite containing phenocrysts of quartz and feldspar. |
| | Metabasalt | Fine grained, usually greenish gray. |
| | Greenstone | Greenish-gray fine-grained porphyritic metabasalt and epidosite, undifferentiated. |
| | Epidosite | Fine to medium grained, granular, yellow green; contains a few amygdaloidal zones. |
| | Phyllite | Light greenish to green gray. |
| | Metarhyolite breccia | Breccia composed of gray metarhyolite fragments in a reddish matrix. |

## ROCK STRUCTURE

South Mountain is a large asymmetrical anticlinorium. Its axis dips to the southeast and its crest is the western slope of South Mountain.

Although the anticlinorium is the dominant structure, faulting is common. The larger faults are generally steep dipping, related to the stretching and overturning of the fold limbs.

# 495. BUZZARDS ROOST

COUNTY: Franklin TOWNSHIP: Washington

QUADRANGLE: Blue Ridge Summit

LOCATION: About 1.5 miles northwest of the village of Blue Ridge Summit; 0.5 mile north of Pa. Route 16 at Monterey.

REMARKS: Buzzards Roost is a large, exposed ridge of light-colored quartzite (Weverton Formation, Cambrian age). A small quarry at this site provides the visitor with a rare opportunity to study the rocks and geologic structure of this section of South Mountain; rock folding is prominent. The quartzite quarried intermittently here is crushed, washed, and used for roofing granules. This bare quartzite peak or ridge crest provides an ideal roost for local buzzards, hence its name.

**Wildcat Rocks** (496) and **Virginia Rock** (497) (Iron Springs quadrangle), about 1.3 and 2.4 miles to the north, respectively, are along this ridge line (i.e.,

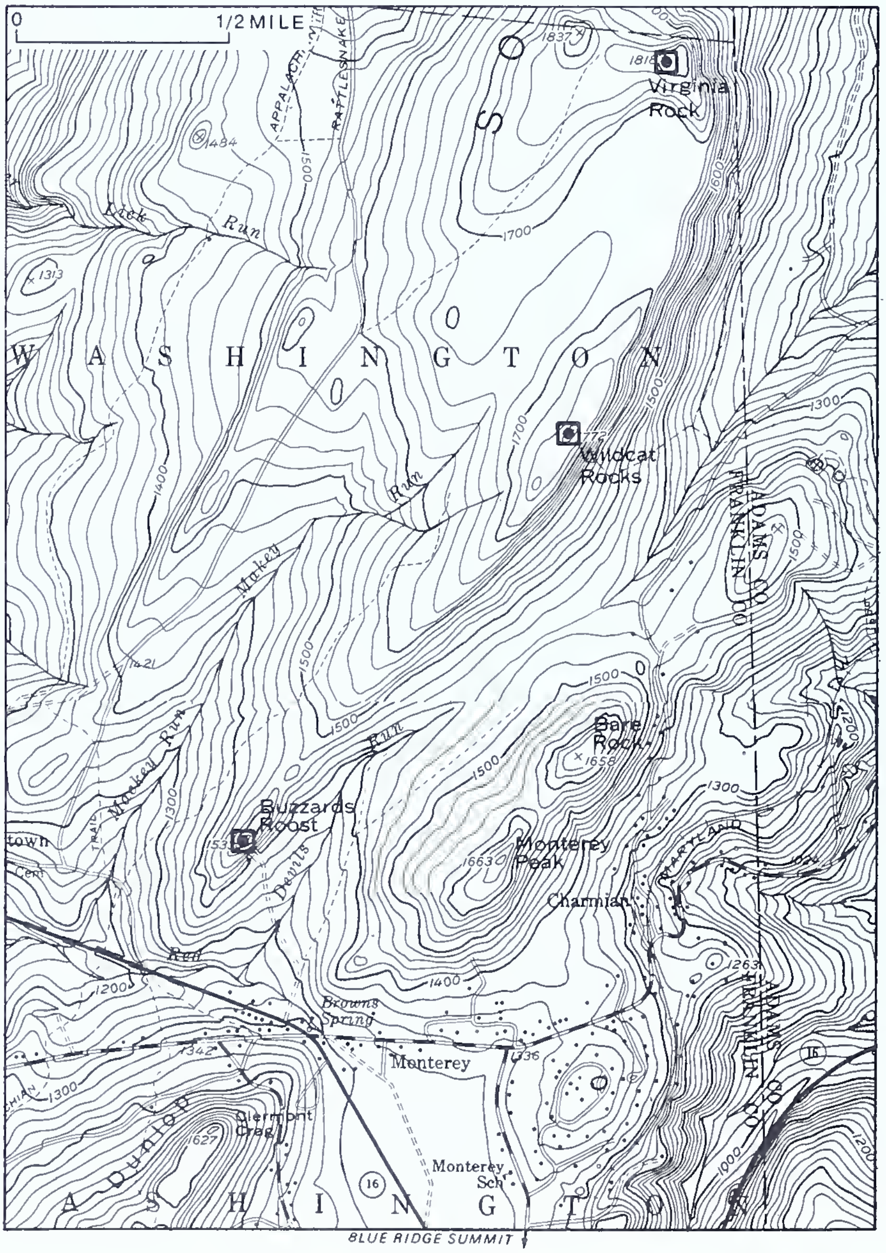
(Photograph by J. P. Wilshusen)

## 495. BUZZARDS ROOST *(continued)*

along the strike of the quartzite) and are very similar in appearance; however, these sites are heavily forested and the quartzite is less exposed.

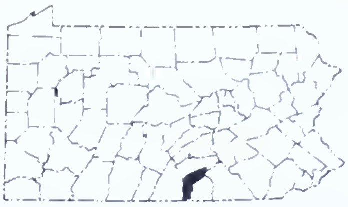
REFERENCES: Fauth, J. L. (1978), *Geology and mineral resources of the Iron Springs area, Adams and Franklin Counties, Pennsylvania,* Pennsylvania Geological Survey, 4th ser., Atlas 129c, 72 p.

Wilshusen, J. P. (1983), *Geology of the Appalachian Trail in Pennsylvania,* Pennsylvania Geological Survey, 4th ser., General Geology Report 74, 121 p.



BLUE RIDGE PROVINCE

SOUTH MOUNTAIN SECTION

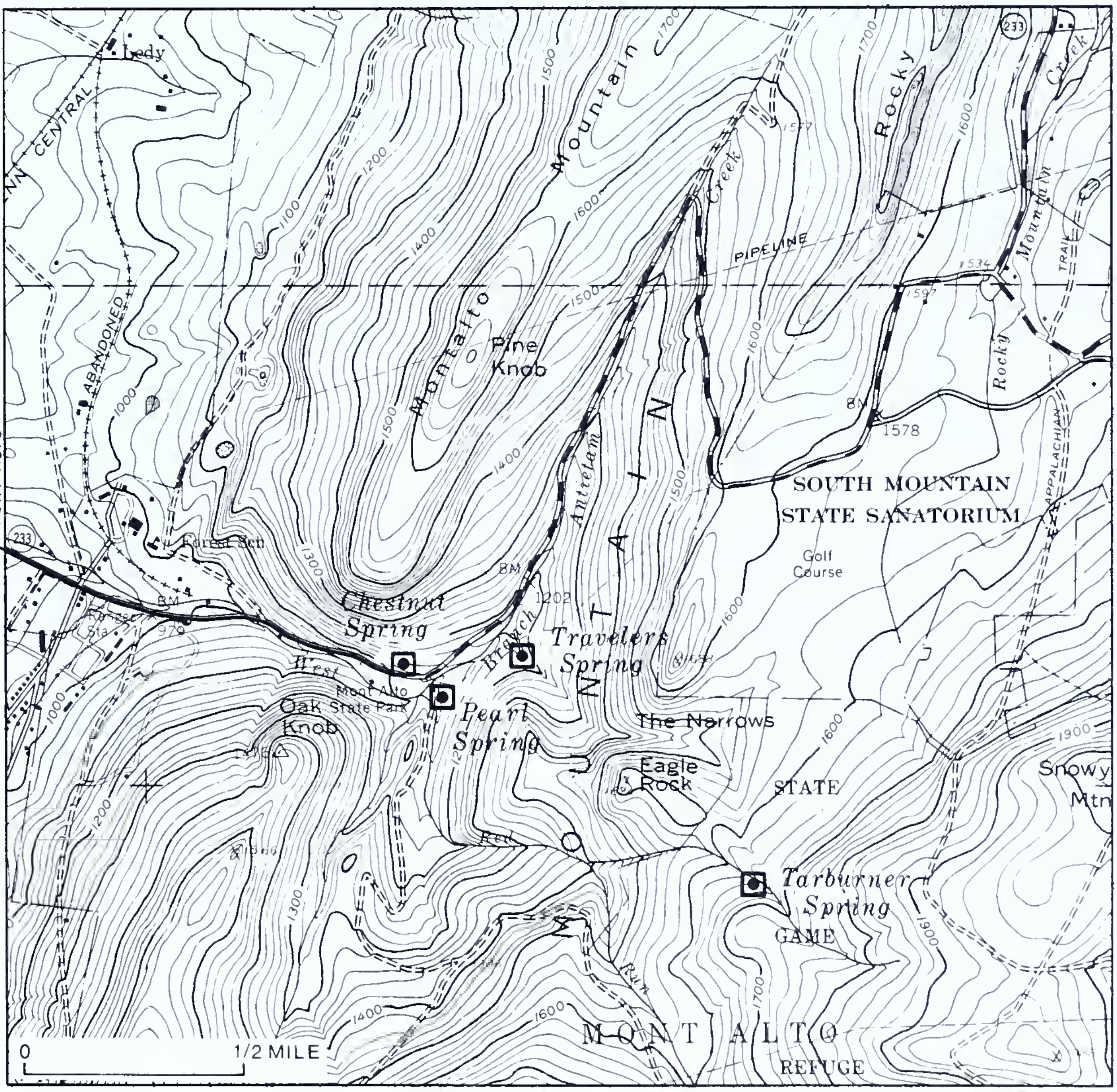


## 498. MONT ALTO GORGE

COUNTY: Franklin TOWNSHIP: Mont Alto

QUADRANGLE: Waynesboro

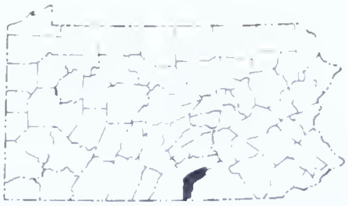
LOCATION: Along Pa. Route 233 and West Branch Antietam Creek, about 1.5 miles east of the borough of Mont Alto; within Mont Alto State Park and Michaux State Forest.



## 498. MONT ALTO GORGE *(continued)*

REMARKS: West Branch Antietam Creek has eroded a highly scenic gorge in South Mountain that is known as

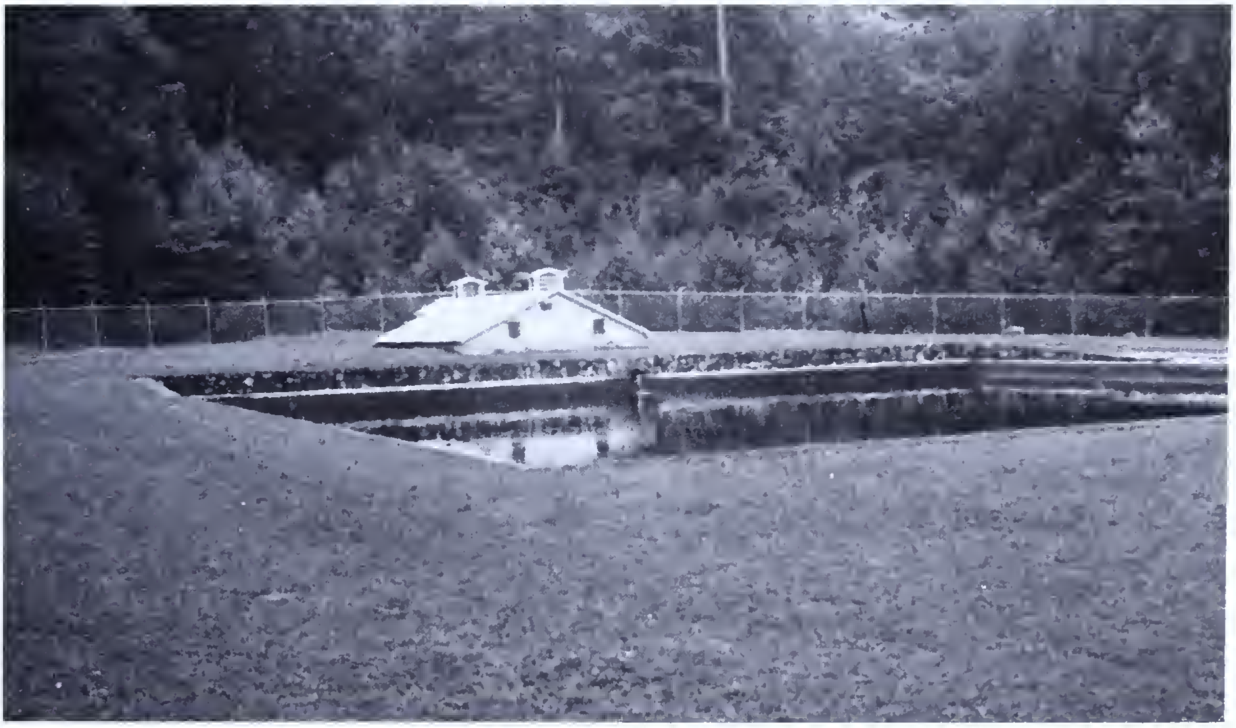
CHESTNUT SPRING



the **Valley of a Thousand Springs**. No one has actually counted them, but there are many. Some of the named ones are **Travelers Spring** (499), **Tarburner Spring** (500), **Chestnut Spring** (EG 7, Part 1, site 320), and **Pearl Spring** (EG 7, Part 1, site 321), also called **Pearl-of-the-Park Spring**. This was the site of the historic Mont Alto Furnace.

REFERENCES: Frazer, Persifor, Jr. (1880), *The geology of Lancaster County,* Pennsylvania Geological Survey, 2nd ser., Report CCC, p. 250.

Geyer, A. R., and Bolles, W. H. (1979), *Outstanding scenic geological features of Pennsylvania,* Pennsylvania Geological Survey, 4th ser., Environmental Geology Report 7, Part 1, p. 391–392.



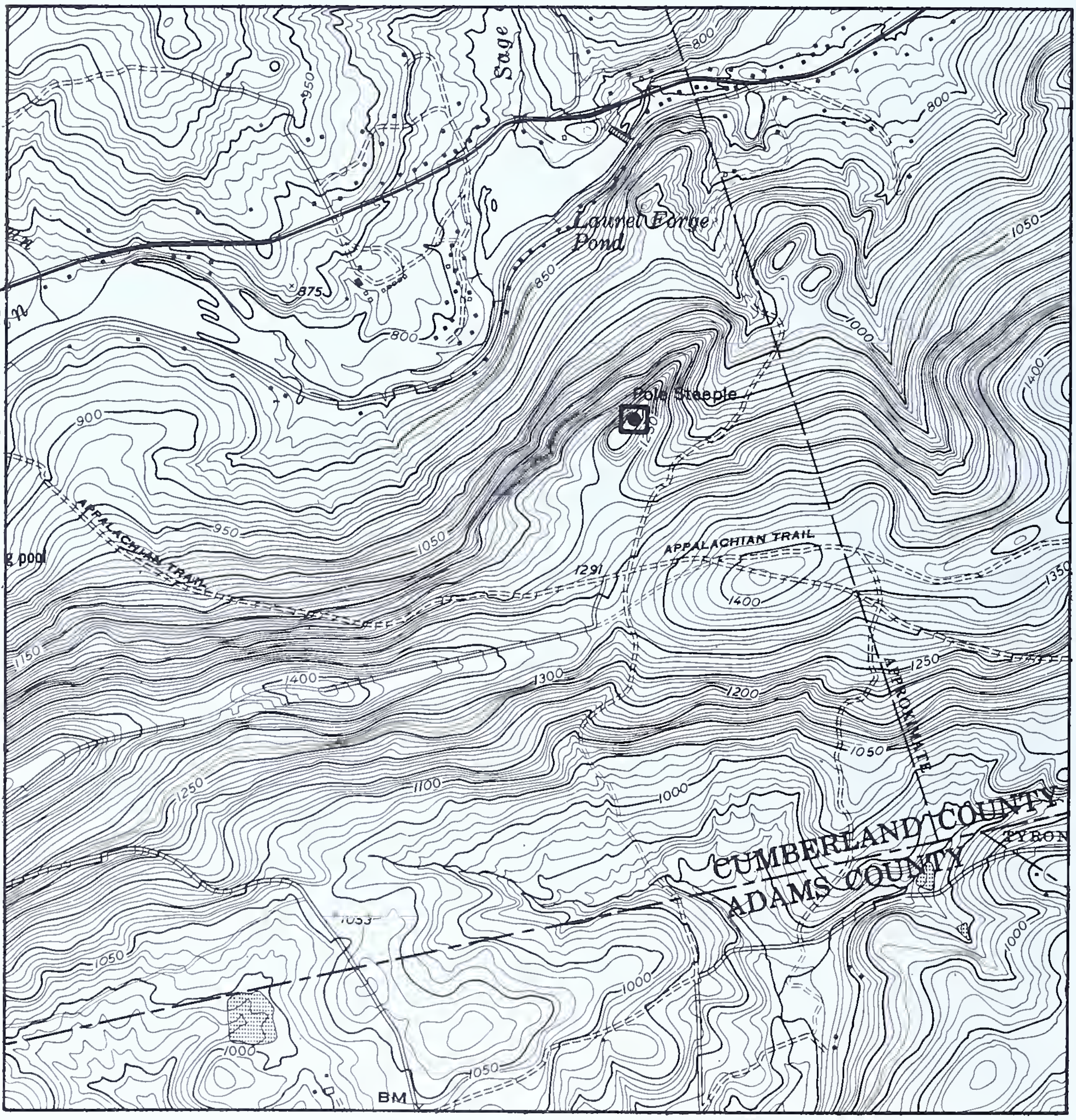
PEARL SPRING

# 501. POLE STEEPLE

COUNTY: Cumberland TOWNSHIP: Cooke

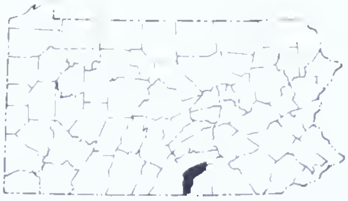
QUADRANGLE: Dickinson

LOCATION: About 2 miles east of the village of Pine Grove Furnace, 0.3 mile north of the Appalachian Trail and 0.4 mile south of Laurel Forge Pond and Pine Grove Furnace State Park.

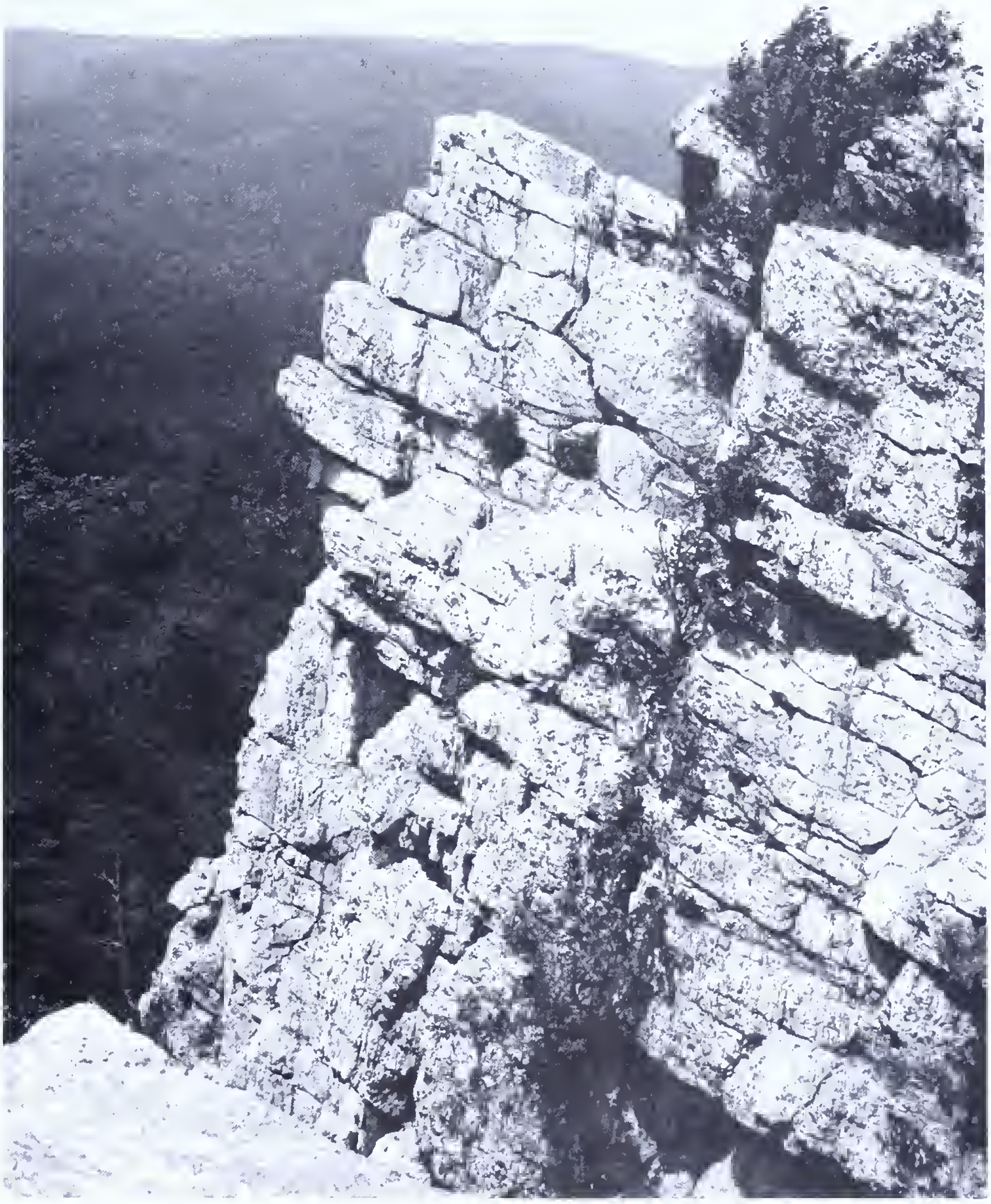


BLUE RIDGE PROVINCE

SOUTH MOUNTAIN SECTION



REMARKS: This magnificent pillar of rock rises over South Mountain and provides an exceptional view of Mountain Creek Valley and the surrounding high-



(Photograph by J. P. Wilshusen)

## 501. POLE STEEPLE *(continued)*

lands. Pole Steeple is a hard, light-gray quartzite (Montalto Member of the Harpers Formation, Cambrian age). Less resistant rocks in the valley to the north around Laurel Forge Pond are metarhyolite and dolomite. These two rock types were faulted upward against the quartzite, and, because they erode more rapidly than the quartzite, they now occupy a lower topographic position.

REFERENCES:

Royer, D. W. [1981], *Caledonia and Pine Grove Furnace State Parks, Cumberland, Adams, and Franklin Counties—Geologic features and iron ore industry,* Pennsylvania Geological Survey, 4th ser., Park Guide 15, pamphlet.

Wilshusen, J. P. (1983), *Geology of the Appalachian Trail in Pennsylvania,* Pennsylvania Geological Survey, 4th ser., General Geology Report 74, 121 p.

NOTES:

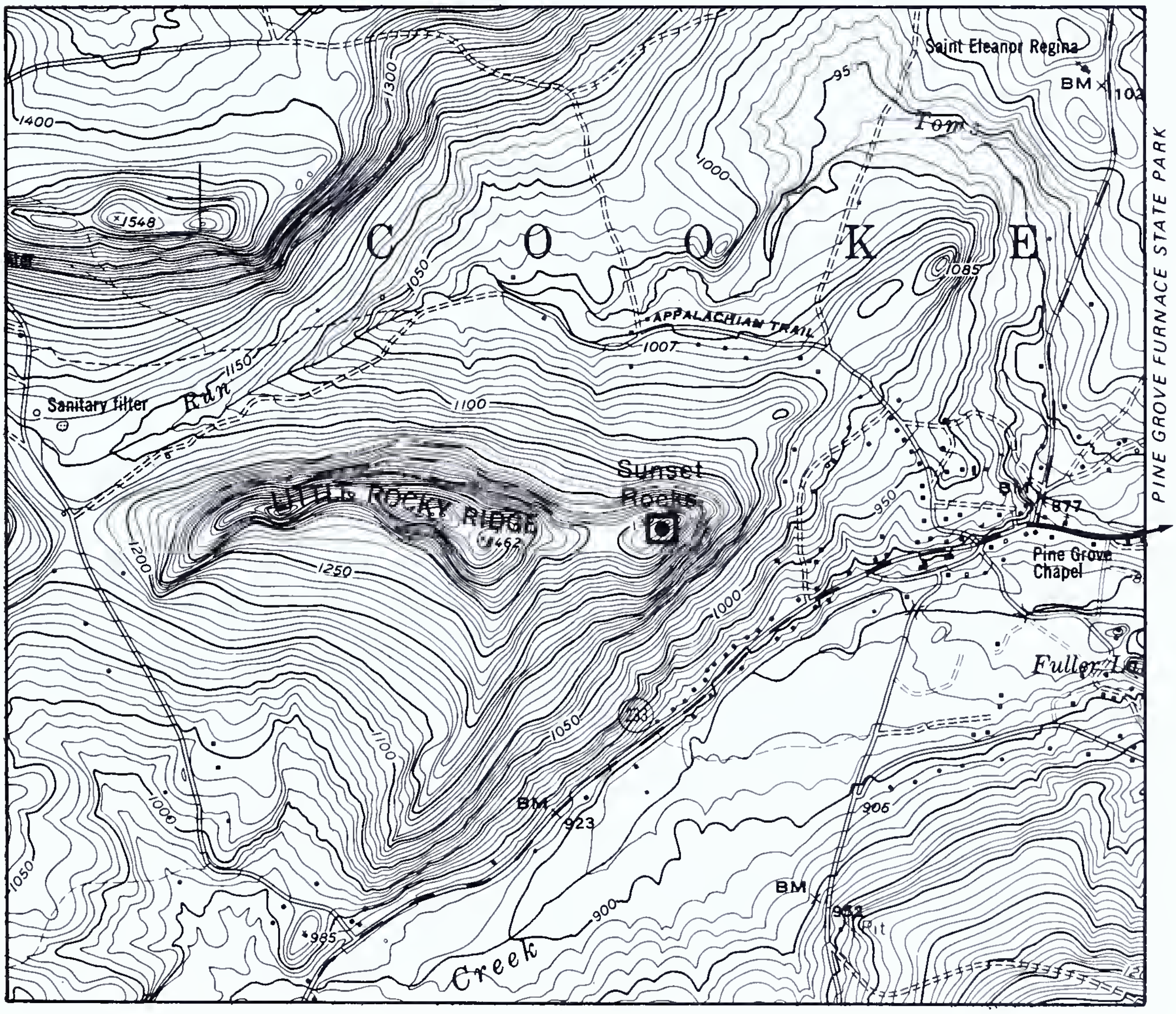
# 502. SUNSET ROCKS

COUNTY: Cumberland TOWNSHIP: Cooke

QUADRANGLE: Dickinson

LOCATION: Little Rocky Ridge, about 1 mile west of Pine Grove Furnace State Park.

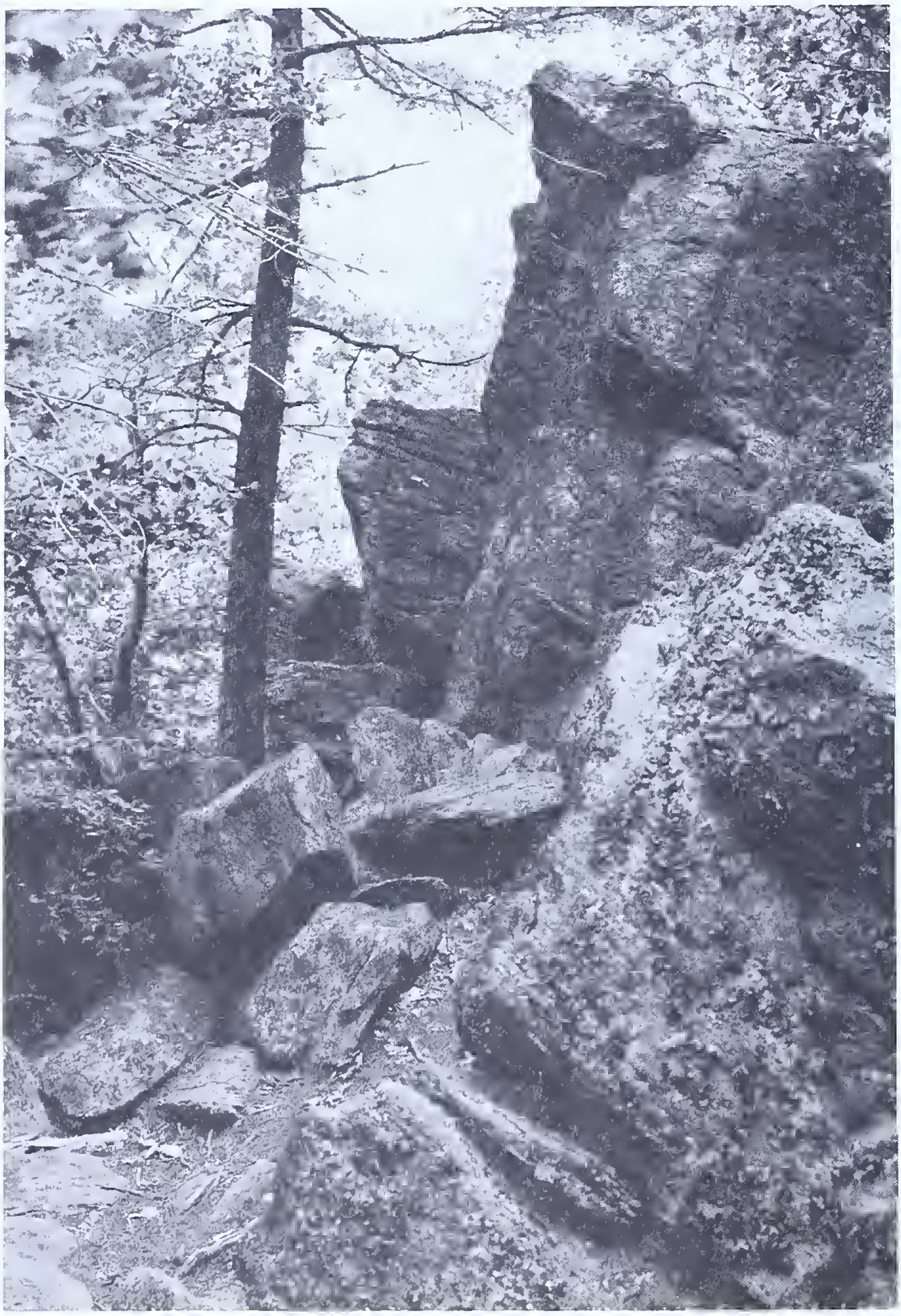
REMARKS: A balanced pinnacle about 15 feet high is a striking solitary feature of Sunset Rocks. Different rates of erosion have caused this hard, dense, light-gray, coarse-grained sandstone and quartzite (Weverton



## 502. SUNSET ROCKS *(continued)*

Formation, Cambrian age) to weather in relief against the surrounding rocks. Individual beds also may weather faster than others, causing the balanced pinnacle.

REFERENCE: Wilshusen, J. P. (1983), *Geology of the Appalachian Trail in Pennsylvania,* Pennsylvania Geological Survey, 4th ser., General Geology Report 74, 121 p.

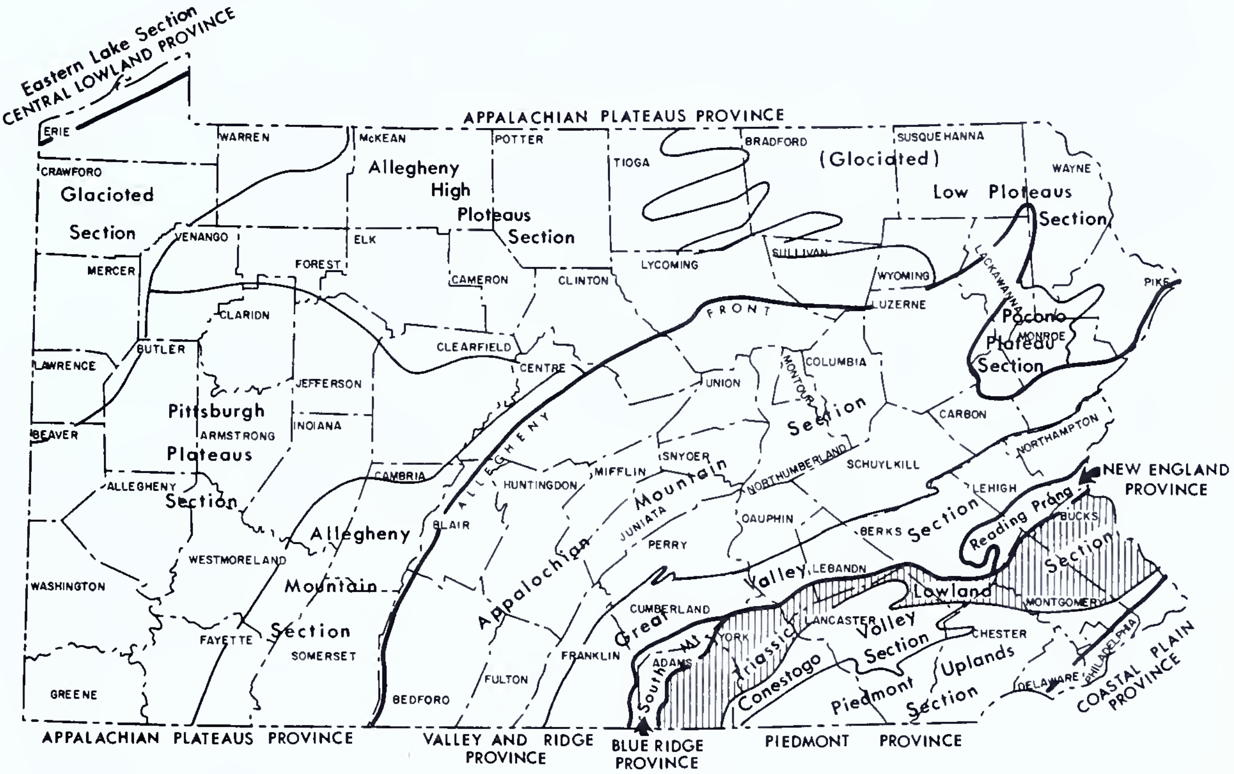


(Photograph by J. P. Wilshusen)

# PIEDMONT PROVINCE— TRIASSIC LOWLAND SECTION

## *TOPOGRAPHY*

The Triassic Lowland section of the Piedmont province is an uplifted plain formed on relatively soft, red sandstone and shale. Higher ridges mark the locations of sheets of hard, dense volcanic rock or lenses of quartz conglomerate. The general level of this rolling plain lies between elevations of about 400 and 600 feet above sea level. Some ridge tops rise to over 1,200 feet. The term "lowland" is a misnomer in Pennsylvania in that the section is characterized by hills and mountains and the red shale and Triassic sandstone terrain is actually much higher than the adjacent limestone valleys.



## *ROCK COLUMN*

The red shales and sandstones of Triassic age are the common rocks of the section. Near the northern border beds of limestone conglomerate interbedded with red shale occur in places. This conglomerate contains well-rounded quartzite pebbles, limestone pebbles, and calcareous sandstone pebbles.

Diabase, a fine-grained igneous rock, is widespread in the form of dikes, sills, and sheets throughout the section. Where the diabase has intruded, it has baked the nearby rocks, making them harder, denser, and less porous. A very small lava flow is exposed at Jacksonwald, 5 miles east of Reading. The description of the rock units is as follows:

| SYSTEM | ROCK UNIT | DESCRIPTION |
|---|---|---|
| Triassic | Diabase | Black, dense, very fine grained; consists of 90 to 95 percent labradorite and augite. |
| | Brunswick Formation | Red shale and sandstone; some limestone and quartz conglomerate; altered to black hornfels adjacent to diabase intrusives; fanglomerates along the northern margin. |
| | Gettysburg Formation | Red coarse-grained sandstone containing interbeds of red shale and quartz conglomerate. |
| | Lockatong Formation | Gray argillite; altered to black hornfels adjacent to diabase intrusives. |
| | Stockton Formation | Red, gray, and brown shale and arkose. |
| | New Oxford Formation | Light-gray coarse-grained sandstone and conglomerate and thin beds of red shale. |

## *STRUCTURE*

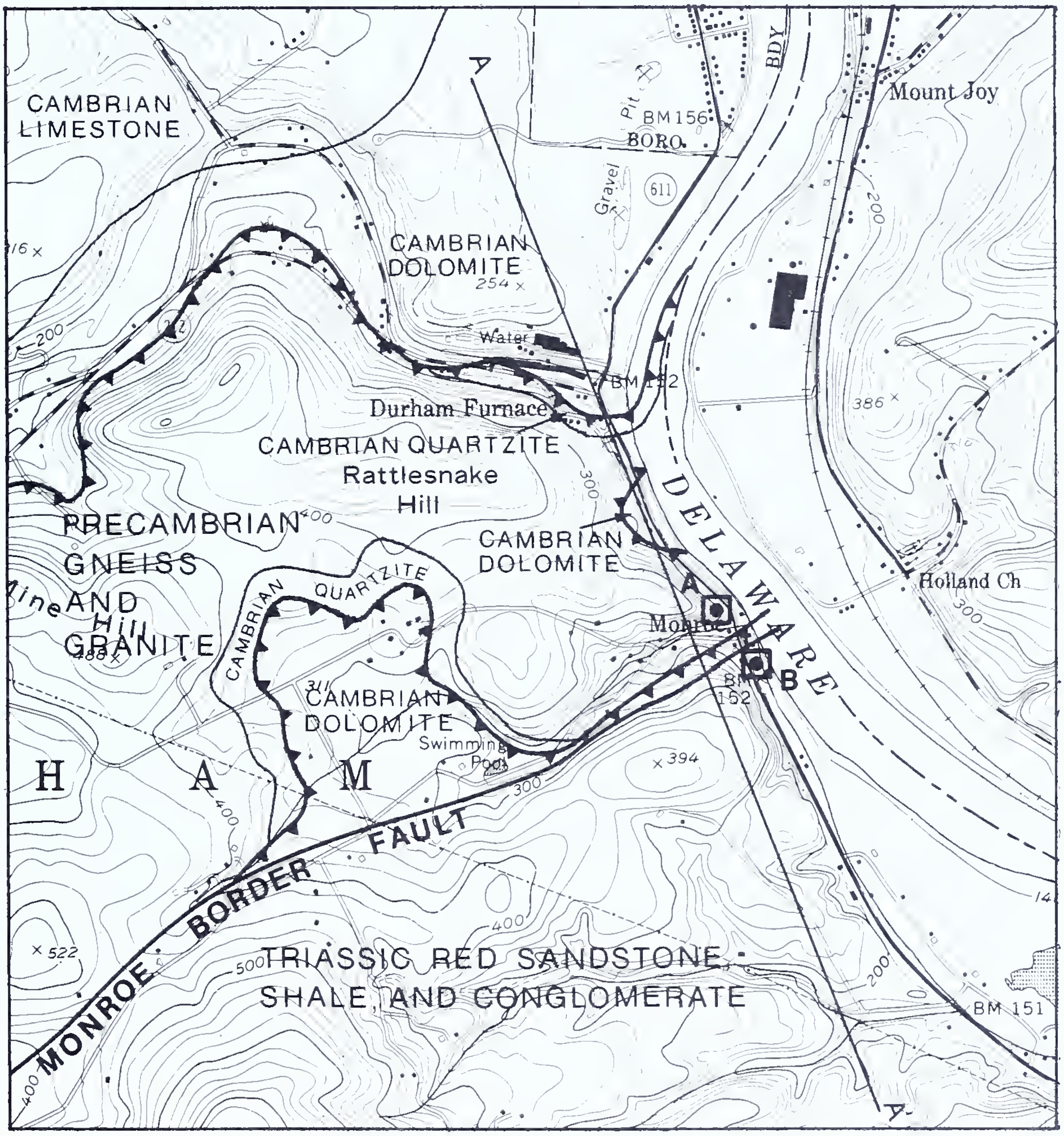
The regional geologic structure of these rock layers can be described as a homocline having moderately steep northward to northwesterly dips, intersected by faults. Minor cross faults offset some of the rock layers. Major faults occur along the north margin.

# 503. MONROE BORDER FAULT

COUNTY: Bucks TOWNSHIP: Durham

QUADRANGLE: Riegelsville

LOCATION: Adjacent to Pa. Route 611 at the village of Monroe; the fault is parallel to Lehnenberg Road.



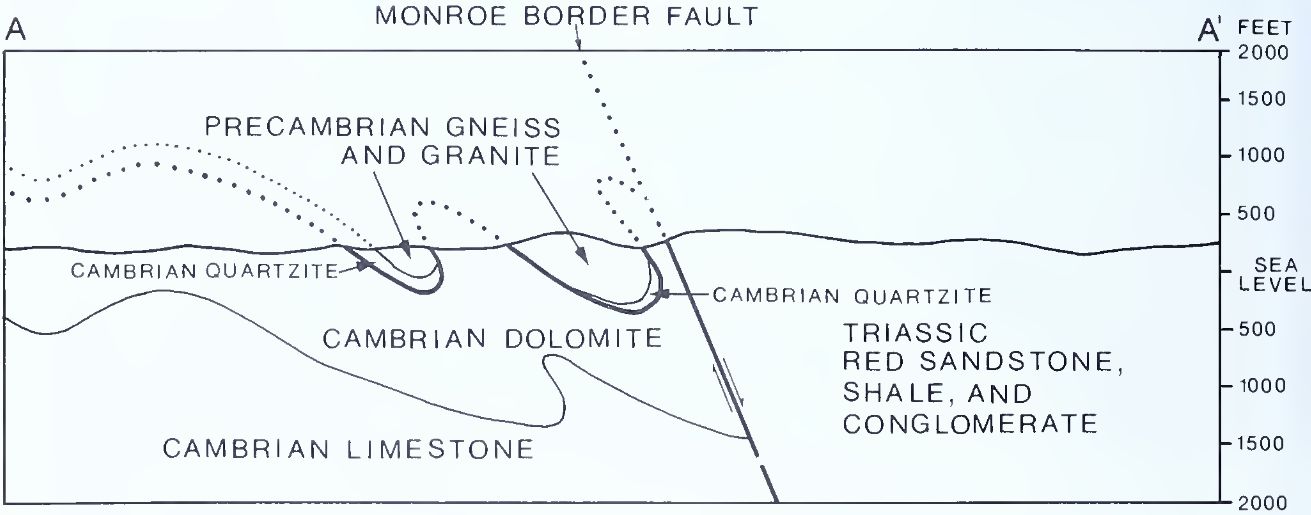
GEOLOGIC MAP
(After Drake and others, 1967)

## 503. MONROE BORDER FAULT *(continued)*

REMARKS: The Monroe Border Fault (also known as the **Triassic Border Fault**) and the adjacent rock units are evidence of large-scale movement within the crust of the earth.

Immediately north of the fault, along Pa. Route 611 and Lehnenberg Road, igneous and metamorphic rocks (granite, granite gneiss, and amphibolite) are exposed. Some of these rocks are over 1 billion years old and are the oldest rocks found at the surface in the Commonwealth. The granite and gneiss here and farther to the north are part of the Reading Prong section of the New England physiographic province. Within the Reading Prong may be found a series of complex folded thrust sheets formed 430 to 600 million years ago.

About 250 million years ago the Monroe Border Fault was formed. It is a normal fault, having the down-dropped block to the south; the fault plane dips steeply south. A deep valley in the area south of the fault was formed. Lakes and swamps developed in the valley, the climate was near tropical, dinosaurs roamed the area, and streams laden with sediment poured over the edge of the fault scarp into the valley. Over millions of years, this valley

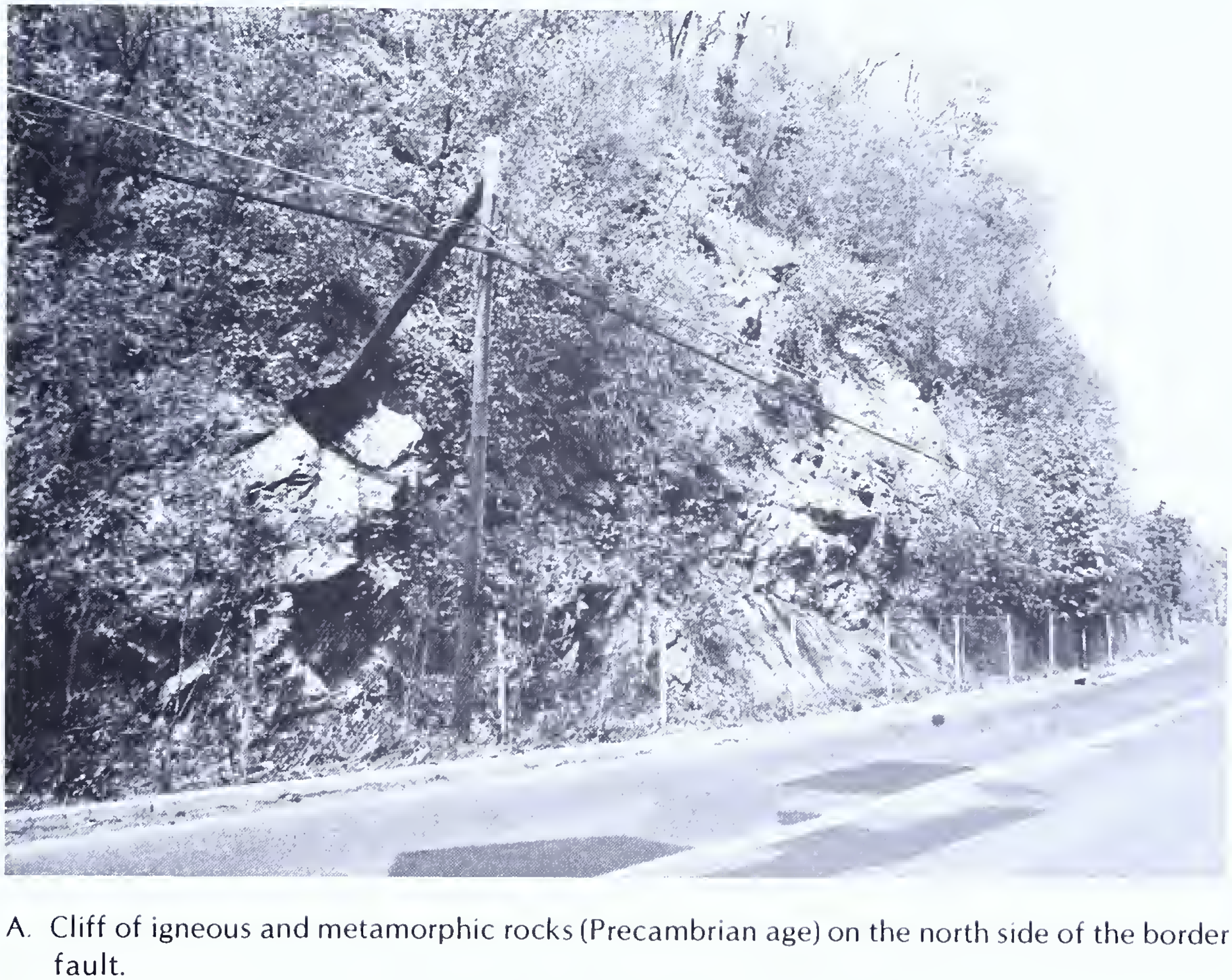


CROSS SECTION
(After Drake and others, 1967)

gradually filled with sediments (red sandstones, shales, and limestone-quartz conglomerates of the Brunswick Formation, Triassic age). These rocks may be seen south of the fault along Pa. Route 611 and in a small quarry immediately south of the intersection of Pa. Route 611 and Lehnenberg Road.

The area has been designated a National Natural Landmark. At this one site may be observed evidence of plate tectonics, mountain building, early earth history, faulting, and valley filling.

REFERENCE: Drake, A. A., Jr., McLaughlin, D. B., and Davis, R. E. (1967), *Geologic map of the Riegelsville quadrangle, Pennsylvania-New Jersey,* U.S. Geological Survey Geologic Quadrangle Map GQ-593, scale 1:24,000.



A. Cliff of igneous and metamorphic rocks (Precambrian age) on the north side of the border fault.

## 503. MONROE BORDER FAULT *(continued)*

B. Red sandstone, shale, and conglomerate (Triassic age) on the south side of the fault.

NOTES:

# 504. SENTINEL ROCK

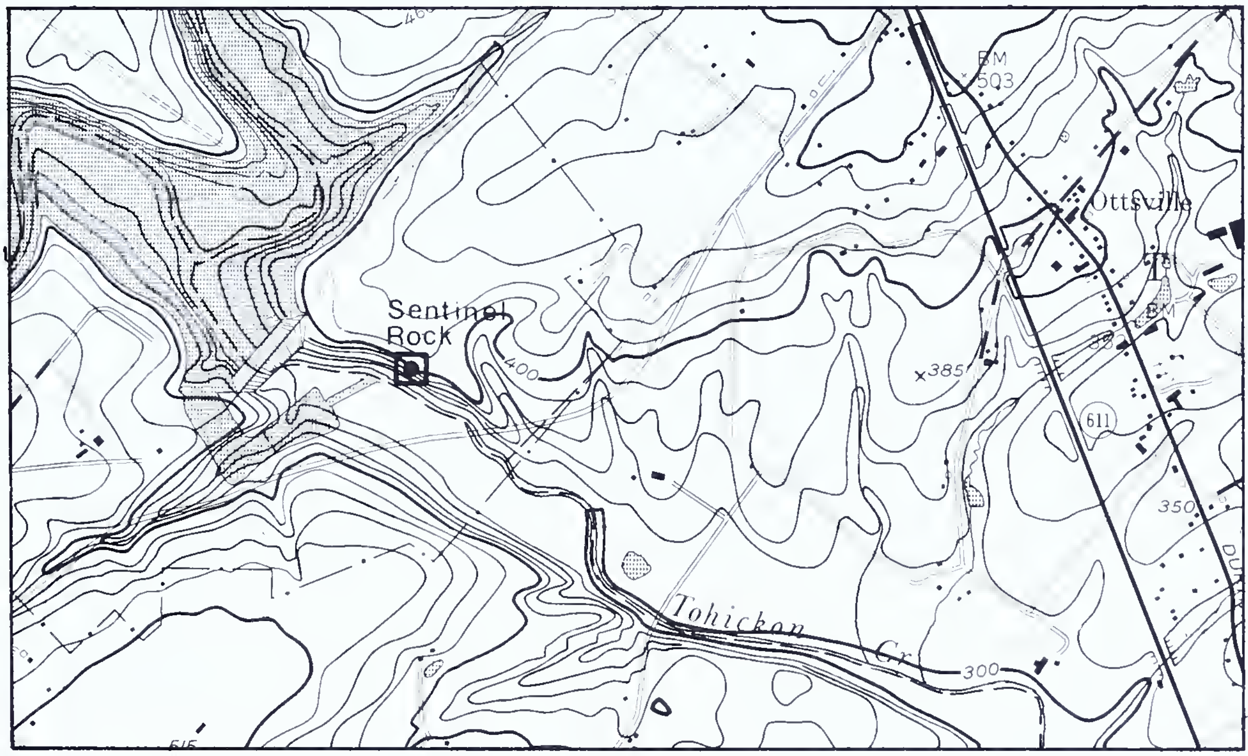
COUNTY: Bucks TOWNSHIP: Nockamixon

QUADRANGLE: Bedminster

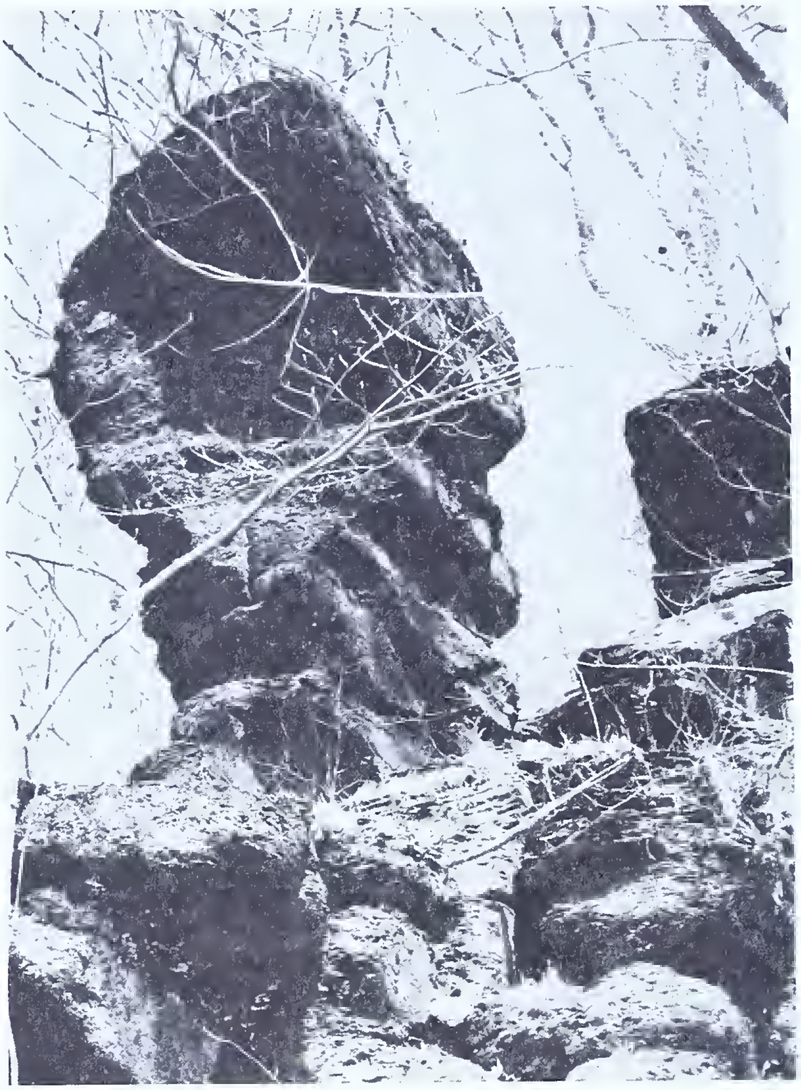
LOCATION: Within Nockamixon State Park, about 1,000 feet downstream of the crest of Nockamixon Dam in the gap of Tohickon Creek.

REMARKS: The rock is a 25-foot erosional pinnacle of red shale and siltstone (Brunswick Formation, Triassic age) formed by differential weathering along rock joints and irregular curved fractures.

REFERENCE: Inners, J. D. [1980], *Nockamixon State Park, Bucks County—Rocks and joints,* Pennsylvania Geological Survey, 4th ser., Park Guide 14, pamphlet.



## 504. SENTINEL ROCK *(continued)*



(Photograph by J. D. Inners)

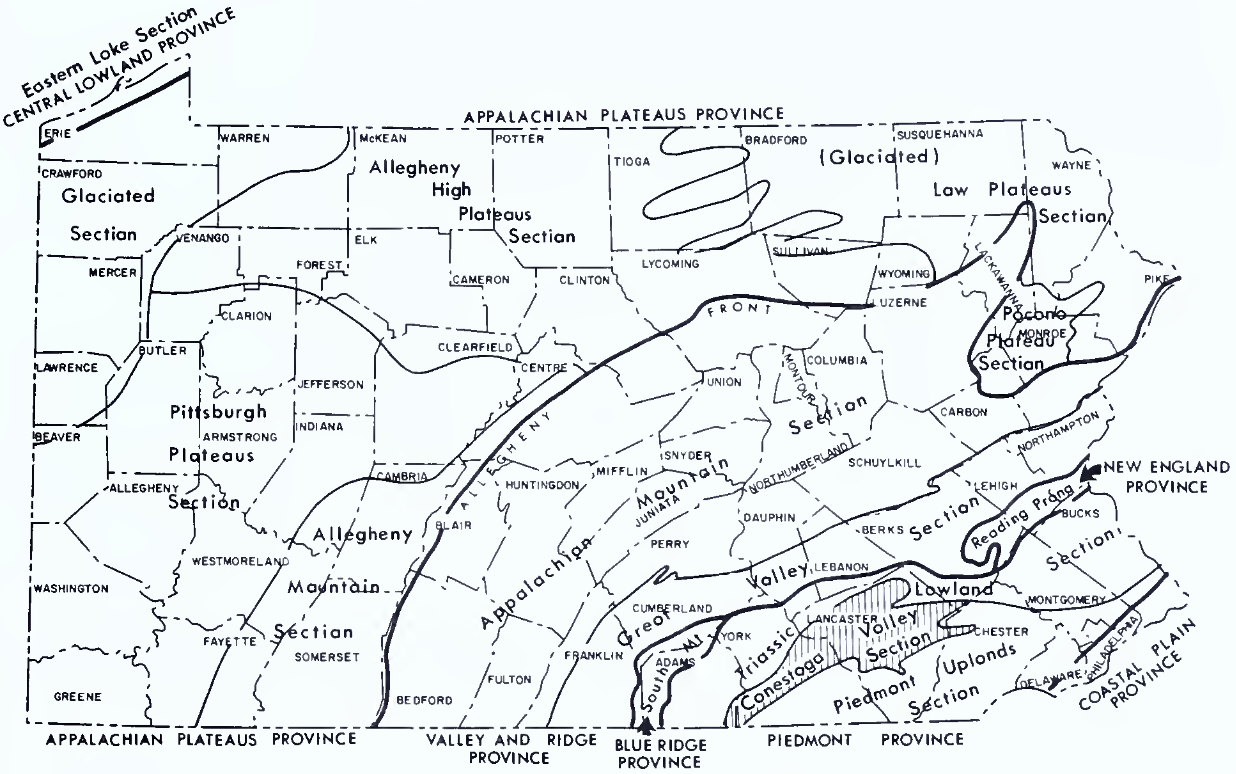
NOTES:

# PIEDMONT PROVINCE— CONESTOGA VALLEY SECTION

## *TOPOGRAPHY*

The Conestoga Valley section is a lowland underlain by shale and carbonate rocks (limestone and dolomite). On the north it is bounded by the Triassic Lowland section and on the south by the Piedmont Uplands section. Both of these sections contain rocks that are at a higher elevation than those of the Conestoga Valley section.

The carbonate rocks of the section lie about 200 to 300 feet below the shale hills, which rise out of the lowlands. The limestone part of the valley contains sinkholes, disappearing streams, caves, and pinnacle weathering, similar to those found in the Great Valley section.



## *ROCK COLUMN*

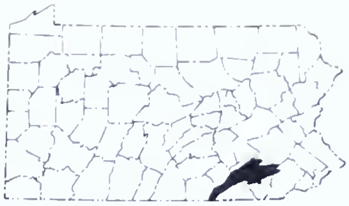
The carbonate rocks of Cambrian and Ordovician age form a rock column more than 10,000 feet thick. Siliceous rocks of Early and Late Cambrian age overlie the carbonate rocks. Precambrian rocks are exposed in small areas of the Pigeon Hills and Hellam Hills.

A detailed description of the rock units in this section follows:

| SYSTEM | ROCK UNIT | DESCRIPTION |
|---|---|---|
| Ordovician | Cocalico Formation | Light-brown shale. |
| | Myerstown Formation | Dark-gray thin-bedded limestone. |
| | Annville Formation | Gray pure limestone. |
| | Beekmantown Group | |
| | Ontelaunee Formation | Gray thick-bedded dolomite. |
| | Epler Formation | Gray interbedded limestone and dolomite, fossiliferous. |
| | Stonehenge Formation | Gray limestone, fossiliferous. |
| Ordovician and Cambrian | Conestoga Formation | Medium-gray impure limestone; includes micaceous limestone and phyllite. |
| Cambrian | Conococheague Group | |
| | Richland Formation | Gray interbedded limestone and dolomite. |
| | Millbach Formation | Pinkish-gray limestone. |
| | Snitz Creek Formation | Gray sandy dolomite. |
| | Buffalo Springs Formation | Yellowish-gray dolomite interbedded with light-gray limestone; thick beds of sandy limestone weather to porous sandstone. |
| | Zooks Corner Formation | Gray dolomite; sandy, crossbedded, and ripple marked. |
| | Elbrook Formation | Light-gray limestone and dolomite. |
| | Ledger Formation | Light-gray sparkling dolomite. |
| | Kinzers Formation | Gray shale; in part, fossiliferous limestone and a pure, high-calcium limestone. |
| | Vintage Formation | Gray dolomite. |
| | Antietam Formation | Gray iron-stained quartzite. |
| | Harpers Formation | Greenish-gray phyllite schist containing quartzite layers. |
| | Chickies Formation | Light-gray, hard, dense quartzite; includes Hellam Conglomerate Member. |
| Precambrian | Metabasalt<br>Volcanic slate<br>Metarhyolite | Occur in small areas in northern York County. |

## *ROCK STRUCTURE*

The cumulative effects of repeated periods of mountain building have resulted in a complex structural pattern made up of distorted folds and thrust faults that break many of the fold structures.



# 505. DONEGAL SPRING

COUNTY: Lancaster TOWNSHIP: East Donegal

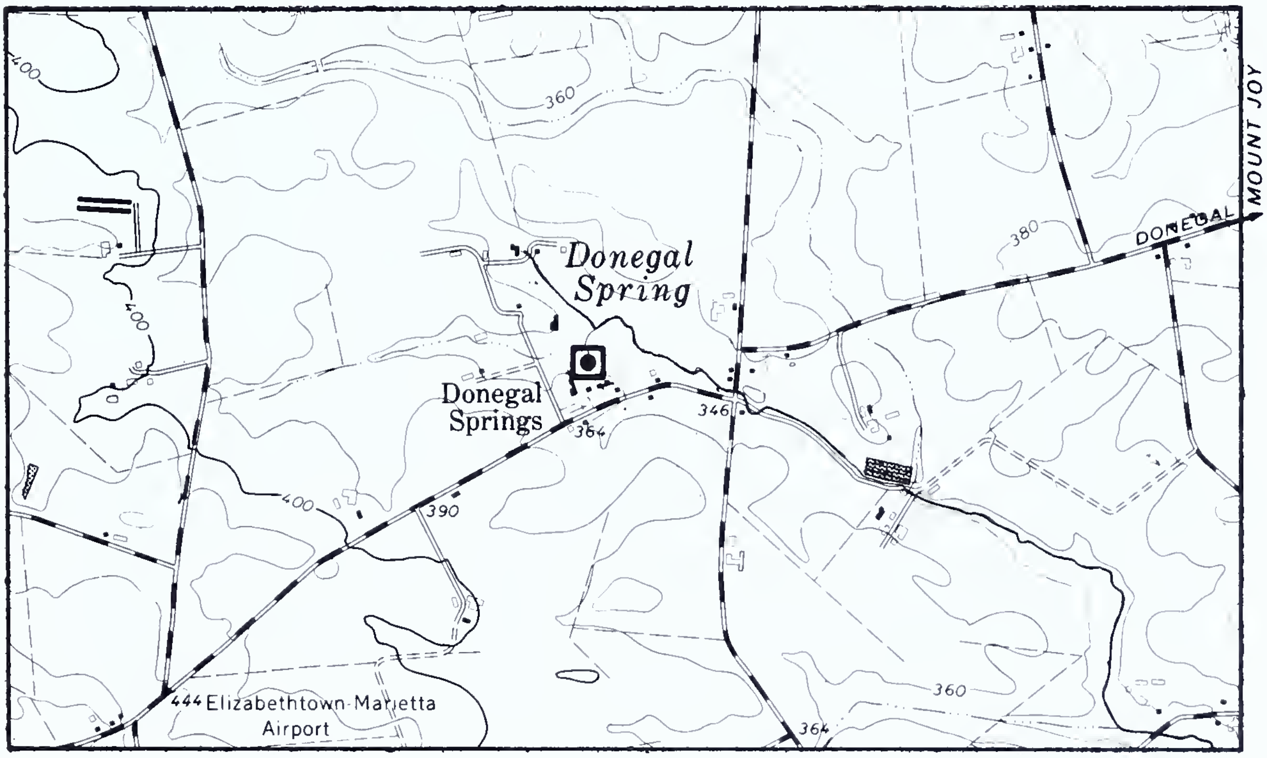
QUADRANGLE: Columbia West

LOCATION: In the village of Donegal Springs on the property of Donegal Presbyterian Church, 3 miles west of the borough of Mount Joy.

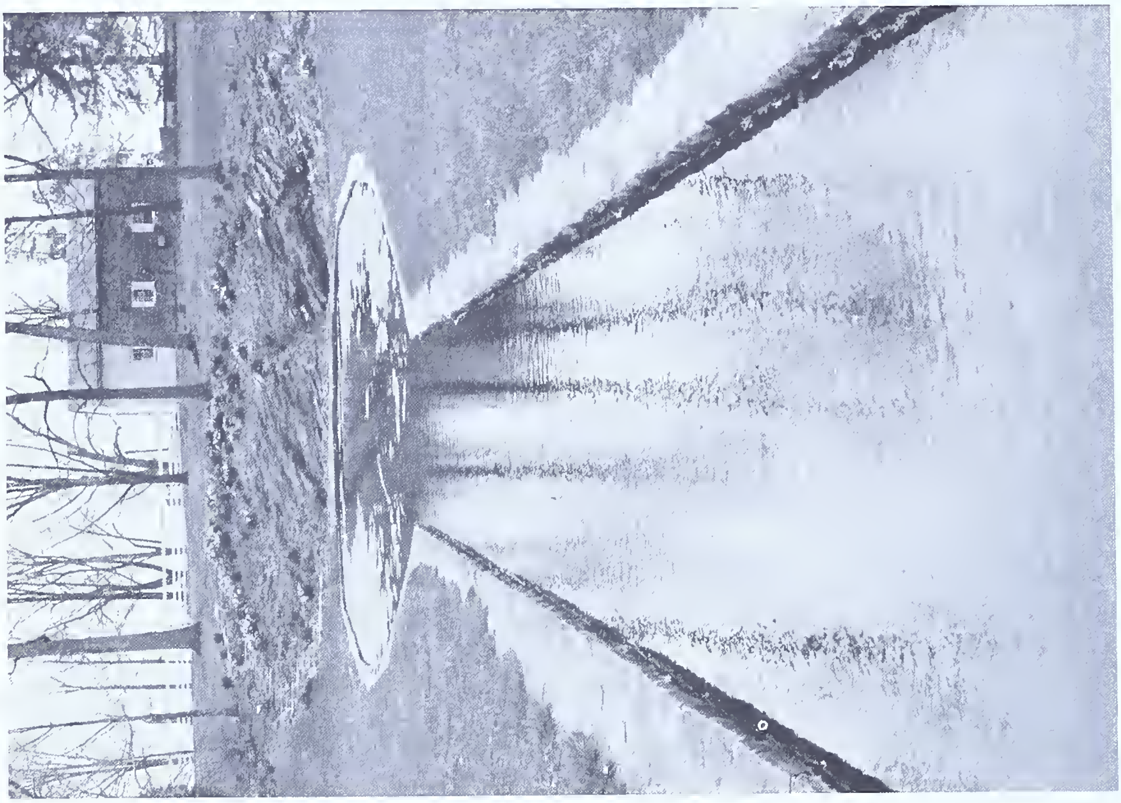
REMARKS: The aquifer is limestone (Stonehenge Formation, Ordovician age); the yield, measured in 1971, ranged from 1,740 to 2,440 gallons per minute.

CHEMISTRY: Temperature, 11.0°C; hardness, 257 milligrams per liter as $CaCO_3$; pH, 7.3.

REFERENCE: Flippo, H. N., Jr. (1974), *Springs of Pennsylvania,* Pennsylvania Department of Environmental Resources, Office of Resources Management, Water Resources Bulletin 10, 46 p.



## 505. DONEGAL SPRING *(continued)*



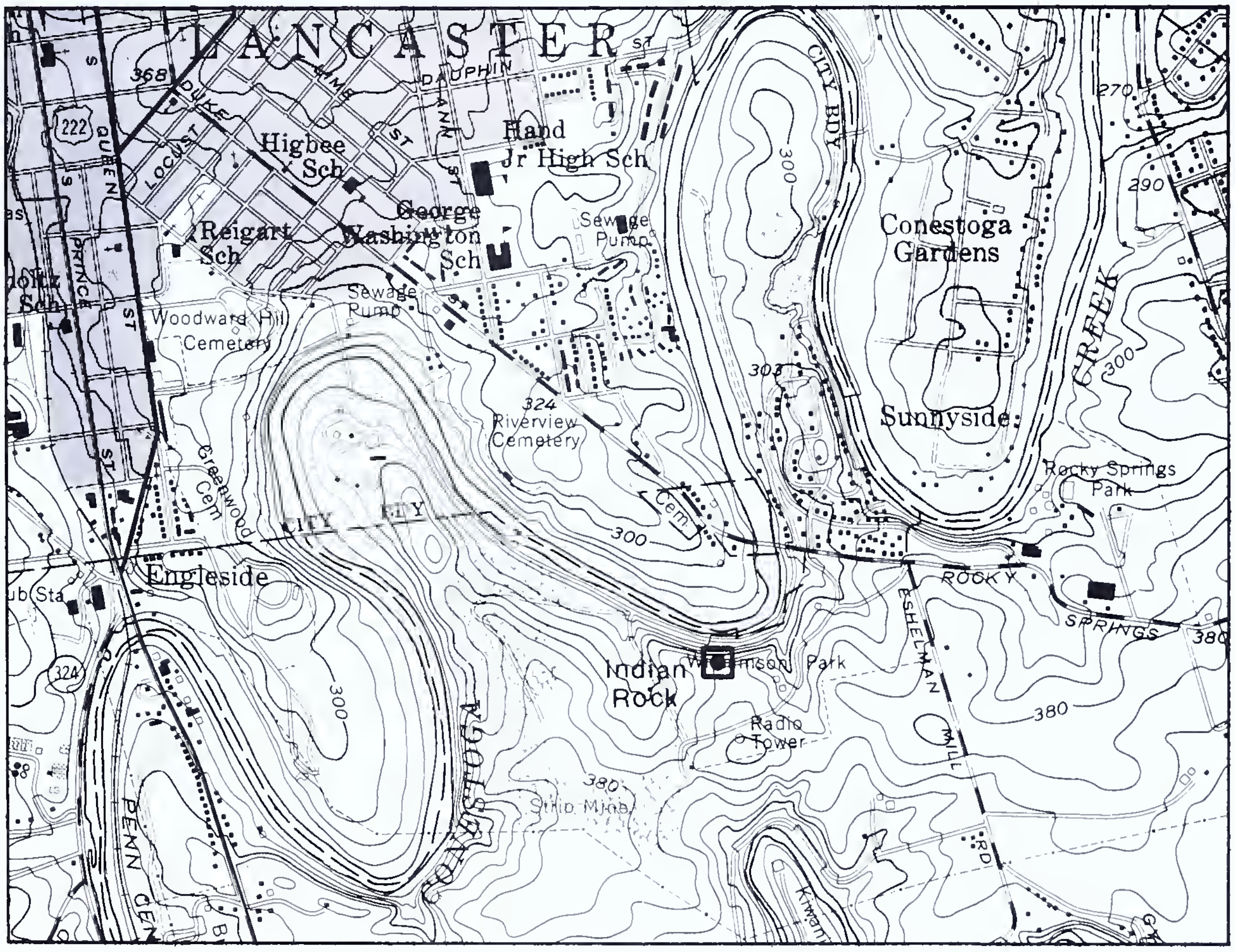
# 506. INDIAN ROCK

COUNTY: Lancaster CITY: Lancaster

QUADRANGLE: Lancaster

LOCATION: Within Williamson Park, one of the parks operated by the City of Lancaster; in the southeast corner of the city, adjacent to Conestoga Creek.

REMARKS: This outcrop of limestone of the Conestoga Formation (Ordovician and Cambrian age) on the edge of a cliff overlooking Conestoga Creek is thought to have been a "lookout" site for a nearby Indian village. The park and Indian Rock are extremely popular for picnickers and geology students, for within the park may be seen some of the most complex geologic structure found in Pennsylvania; this is truly an outdoor laboratory for earth science students.



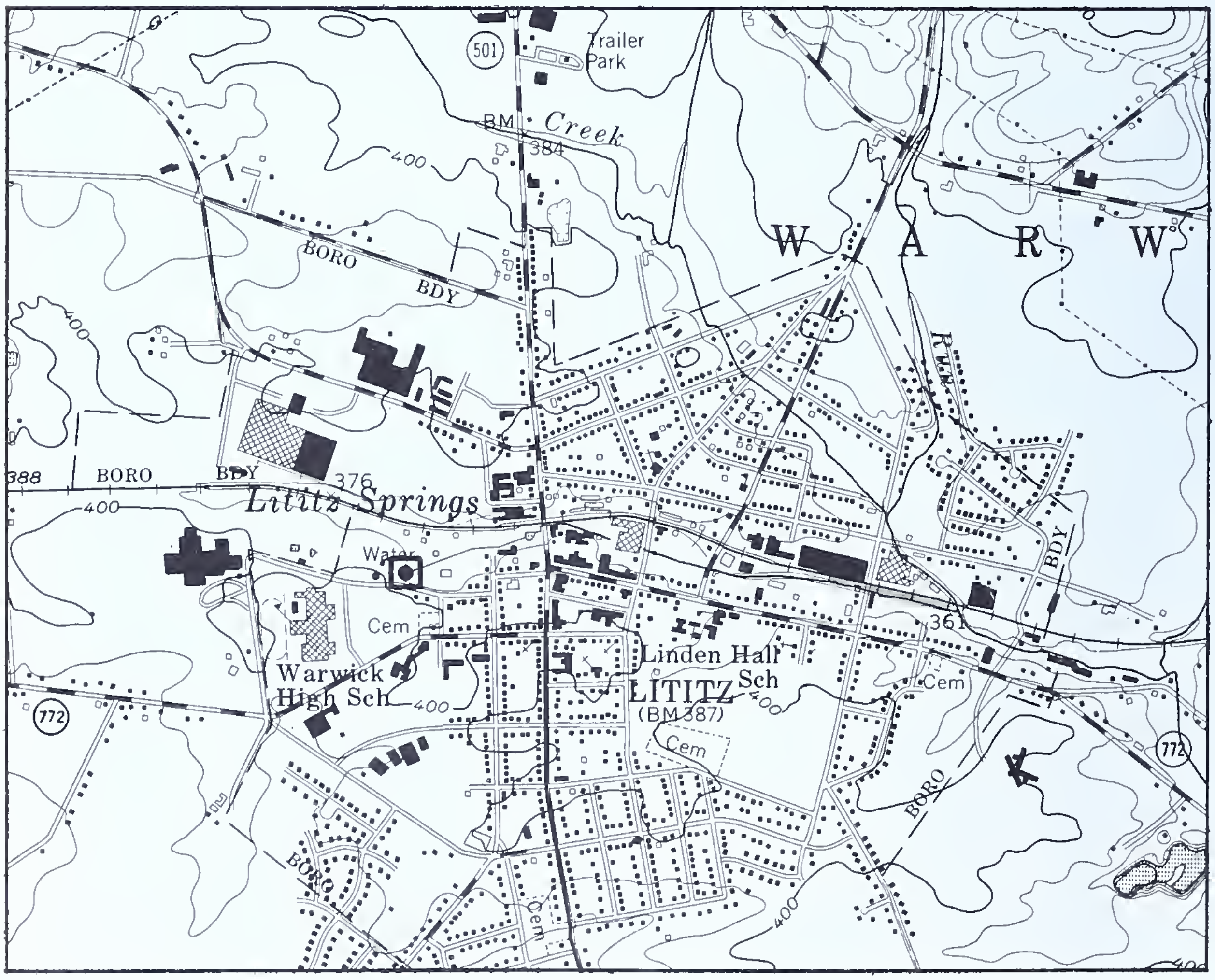
# 507. LITITZ SPRINGS

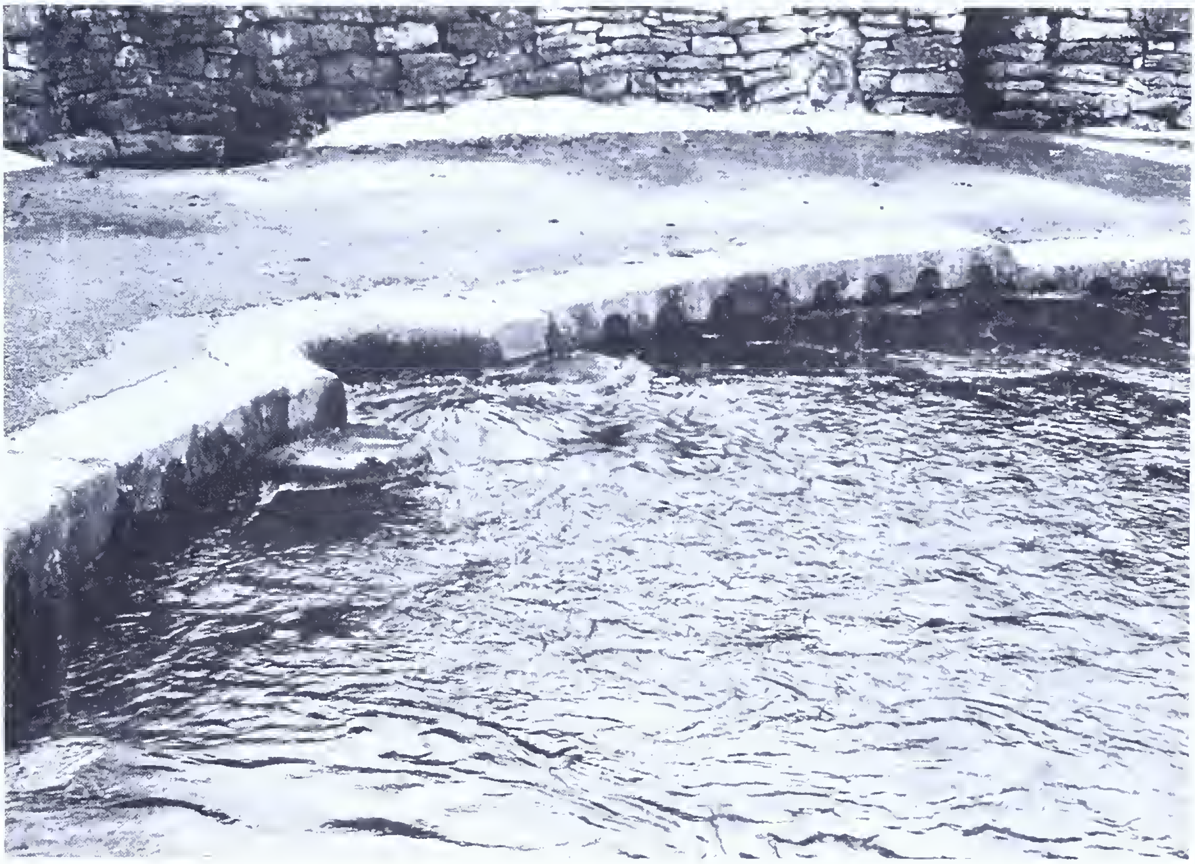
COUNTY: Lancaster TOWNSHIP: Lititz

QUADRANGLE: Lititz

LOCATION: Within the borough of Lititz; the center and focal point of Lititz Springs Park.

REMARKS: One of the largest and most scenic springs in Pennsylvania. Several springs issue from solution openings along joints (fractures) at the base of a large outcrop of limestone and dolomite; the aquifer is the Stonehenge Formation (Ordovician age). The maximum flow from the springs usually occurs in March and April and is in excess of 5,000 gallons per minute; a flow of 1,660 gallons per minute was measured in November 1971.





# 508. RHEEMS QUARRY

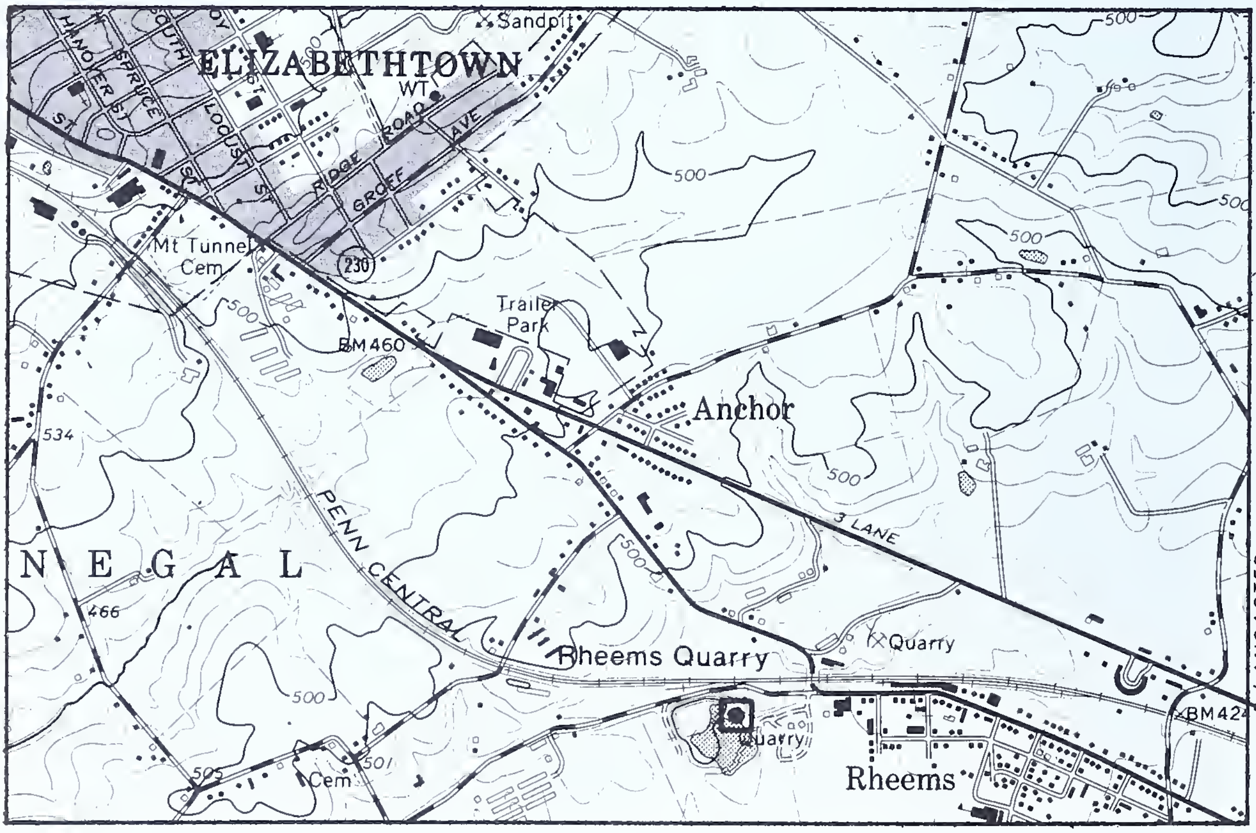
COUNTY: Lancaster TOWNSHIP: West Donegal

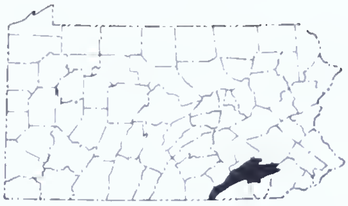
QUADRANGLE: Elizabethtown

LOCATION: Approximately 15 miles northwest of Lancaster; 2 miles southeast of the Elizabethtown borough square, in the village of Rheems.

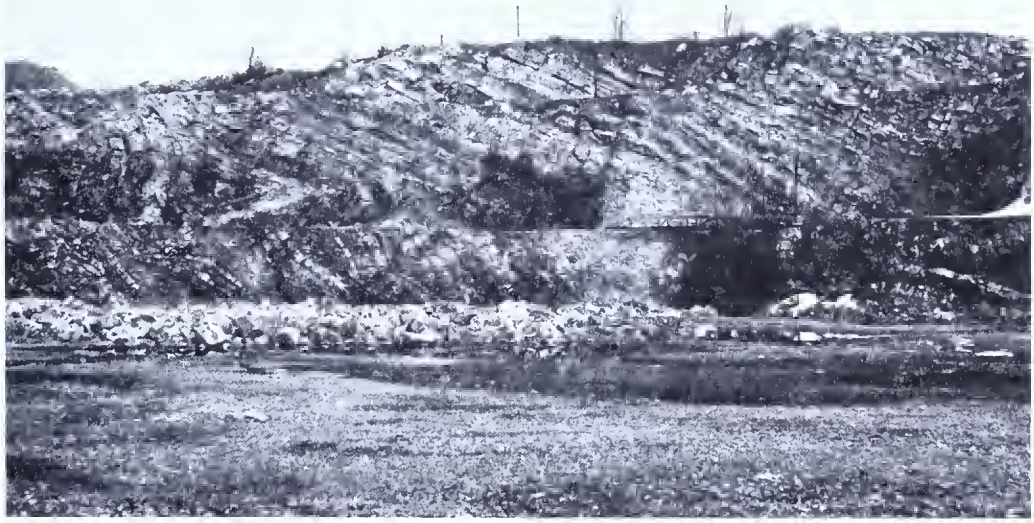
REMARKS: An abandoned quarry contains some of the most intensely folded rocks in Pennsylvania; limestone and dolomite exposures (Epler Formation, Beekmantown Group, Ordovician age) provide evidence of a large nappe (overturned anticline) in the Piedmont of Pennsylvania.

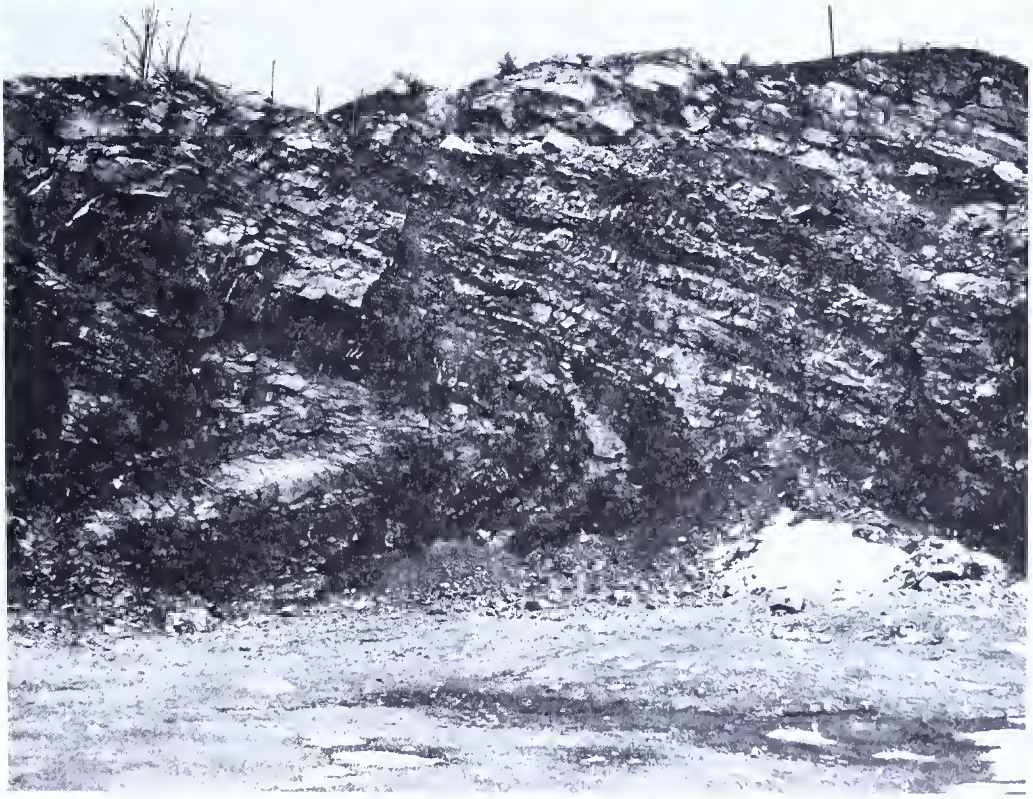
REFERENCE: Wise, D. U. (1960), *Stop 9, Rheems quarry,* in Bricker, O. P., Hopson, C. A., Kauffman, M. E., and others, *Some tectonic and structural problems of the Appalachian Piedmont along the Susquehanna*





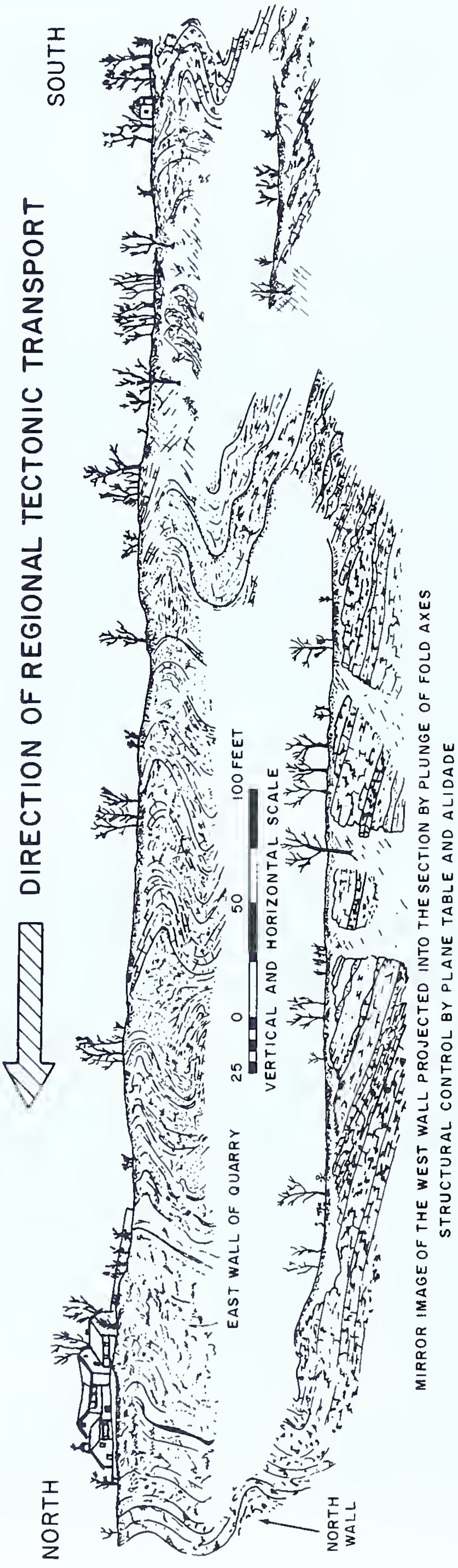
*River,* Annual Field Conference of Pennsylvania Geologists, 25th, Lancaster, Pa., Guidebook, p. 76–83.





(Photographs by R. T. Faill)

## 508. RHEEMS QUARRY *(continued)*


SOUTH
DIRECTION OF REGIONAL TECTONIC TRANSPORT
NORTH
EAST WALL OF QUARRY
25 0 50 100 FEET
VERTICAL AND HORIZONTAL SCALE
NORTH WALL
MIRROR IMAGE OF THE WEST WALL PROJECTED INTO THE SECTION BY PLUNGE OF FOLD AXES
STRUCTURAL CONTROL BY PLANE TABLE AND ALIDADE

(From Wise, 1960, facing p. 82)

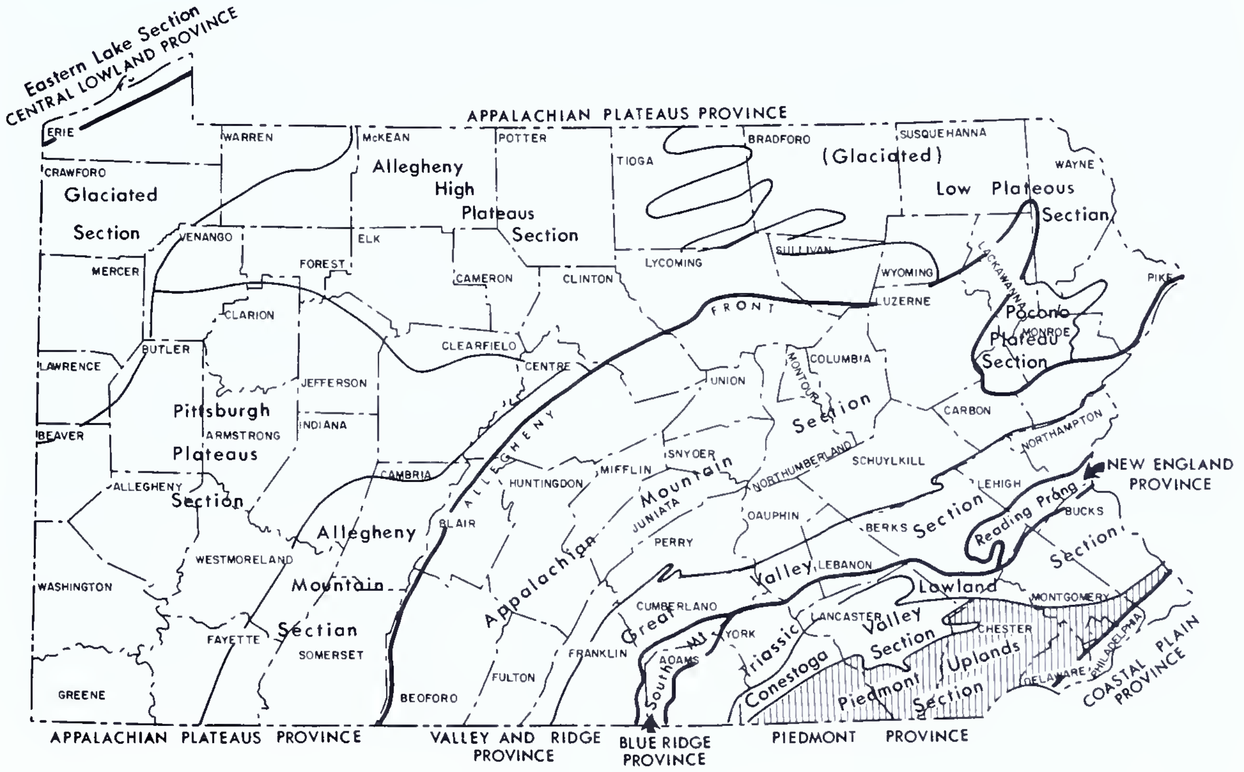
# PIEDMONT PROVINCE— PIEDMONT UPLANDS SECTION

## *TOPOGRAPHY*

The main topographic expression of the section is a series of northeast-southwest-trending uplands of rounded hills dissected by relatively narrow valleys. The Honeybrook Upland is typical, consisting of Welsh Mountain, Mine Ridge, and the South Valley Hills, having a gentle rise in elevation of 150 to 200 feet above the surrounding valleys. A rolling surface dotted with rounded boulders of anorthosite, granodiorite, and quartzite, as well as rock fence rows, is characteristic of the upland. The oldest formation in these hills is the Chickies Formation, which has the massive Hellam Conglomerate Member at its base.

West of the Susquehanna River, from Red Lion westward to the Maryland line, the section contains a divide which is mostly below 900 feet in elevation, but southward, as far as Shrewsbury, it has a broad top over 1,000 feet in elevation. Northwest of this central divide the upland slopes toward the Hanover-York Valley, where it terminates abruptly at elevations of 700 to 900 feet.

East of the Susquehanna River the section is characterized as a dissected upland having narrow interstream areas and flat-topped summits.



## *ROCK COLUMN*

The rocks of the Piedmont Uplands section are metamorphic and igneous types of Late Cambrian to Precambrian age that consist chiefly of schists and quartzites. The igneous rocks of the Piedmont range from granite to very basic rocks, largely altered to serpentinite, and usually weathered to deep soils. Outcrops are scarce, and the best exposures are found in railroad and highway cuts, atop high ridges, and in quarries.

The metamorphic rocks of the section are chiefly schists, quartzites, and gneisses.

A detailed description of the rock units present follows:

| SYSTEM | ROCK UNIT | DESCRIPTION |
|---|---|---|
| Cambrian | Antietam Formation | Slabby, light-gray to rusty-colored schist and quartzite. |
| | Harpers Formation | Garnetiferous chlorite schist; gray sandy phyllite. |
| | Chickies Formation<br>Hellam Conglomerate Member | Light-gray hard massive quartzite; conglomerate at base. |
| Lower Paleozoic | Serpentinite | Includes serpentine, steatite, and other products of alteration of peridotites and pyroxenes. |
| | Peach Bottom Slate | Blue-black slate. |
| | Cardiff Conglomerate | Quartz conglomerate, greenish-gray, weathering to red; pebbles to 3 inches in length. |
| | Peters Creek Schist | Chlorite-sericite schist; quartzite. |
| | Wissahickon Formation | Sparkling, grayish-blue to green schist. |
| | Albite-muscovite-chlorite schist | |
| | Albite-muscovite-chlorite-quartz schist | |
| | Albite-chlorite schist | |
| | Chlorite-muscovite schist | |
| | Chloritoid schist | |
| | Marburg Schist | Silvery-green schist. |
| | Wakefield Marble | White marble. |
| | Cockeysville Marble | Crystalline micaceous marble. |
| | Setters Formation | Tan quartzite. |
| Precambrian | Anorthosite | Blue-gray; weathers into large spheroidal boulders; composed of plagioclase feldspar, hornblende, actinolite, augite, and accessory minerals. |
| | Quartz monzonite and quartz diorite | Light-colored; composed of quartz, feldspar, and biotite; banded. |
| | Granodiorite | Medium-grained quartz-feldspar-mica rock; light-colored pinkish to greenish cast. |
| | Gabbro, gabbroic gneiss, and metagabbro | Dark-colored calcic plagioclase, hypersthene, and quartz rock. |

| SYSTEM | ROCK UNIT | DESCRIPTION |
|---|---|---|
| Precambrian | Graphitic gneiss | Light-gray gneiss; rock exhibits a speckled brown and white appearance. Graphite occurs in flakes disseminated throughout the gneiss. It exhibits a brilliant, glistening, tin-white metallic luster which is helpful in identification. |
| | Pickering Gneiss | Graphitic gneiss, dark-colored. |
| | Franklin Marble | White marble containing graphite. |
| | Hornblende gneiss | Dark-gray hornblende makes up about 50 percent of the rock and labradorite the other 50 percent. |
| | Granitic gneiss | Light-pink color; essential minerals are quartz, microcline, hornblende, and some biotite. |

## *ROCK STRUCTURE*

The major structure of the Piedmont Uplands section is the Mine Ridge anticline, which crosses the entire section and in the southern part is known as the Tucquan anticline. Thrust and normal faults are common. The Martic overthrust, referred to as the Martic Line, is still a controversy as to whether it is a thrust fault, a gradational contact, or a metamorphic-grade contact.

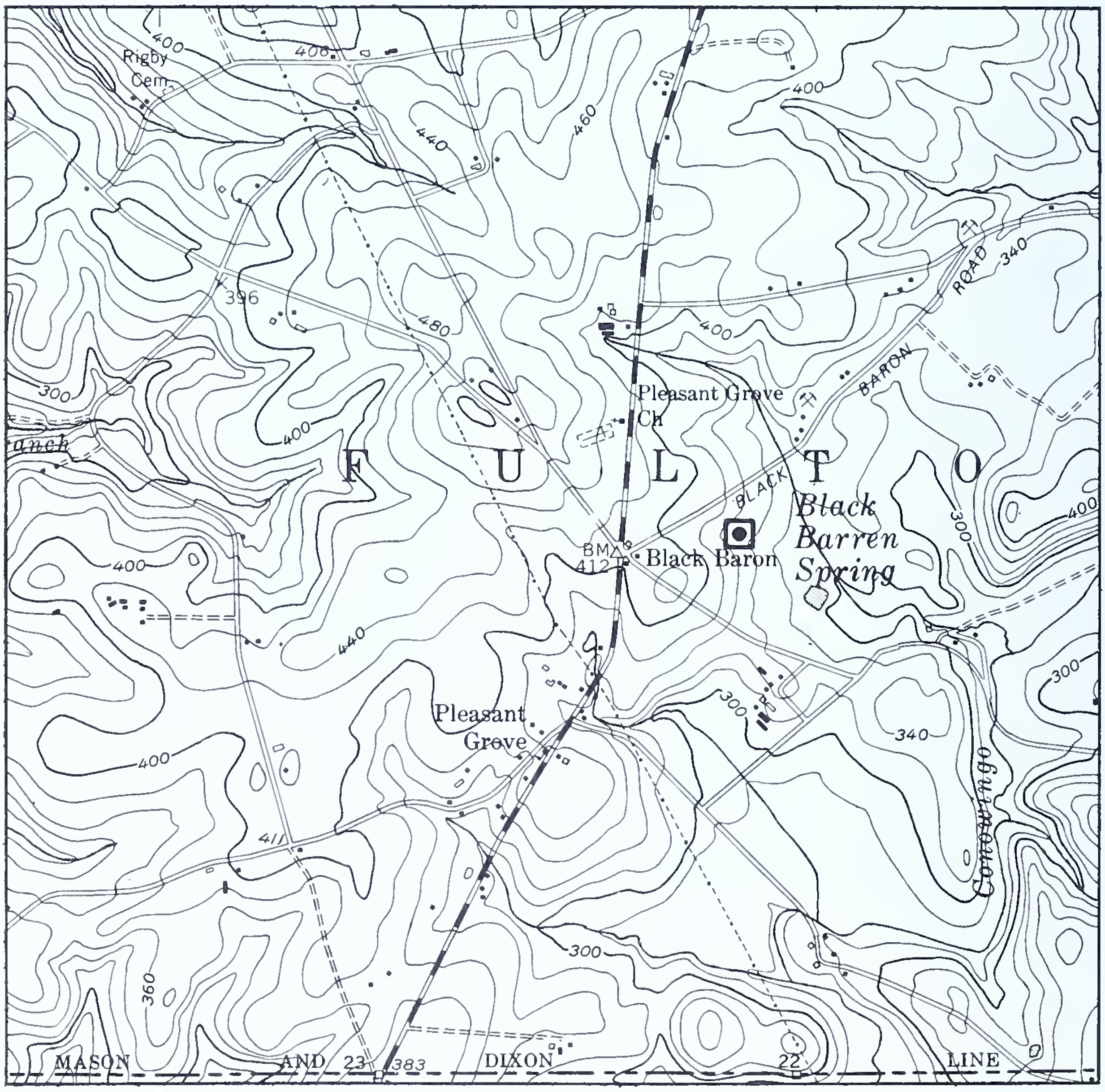
## 509. BLACK BARREN SPRING

COUNTY: Lancaster TOWNSHIP: Fulton

QUADRANGLE: Conowingo Dam

LOCATION: About 0.2 mile east of the crossroads at Black Baron, along Black Baron Road.

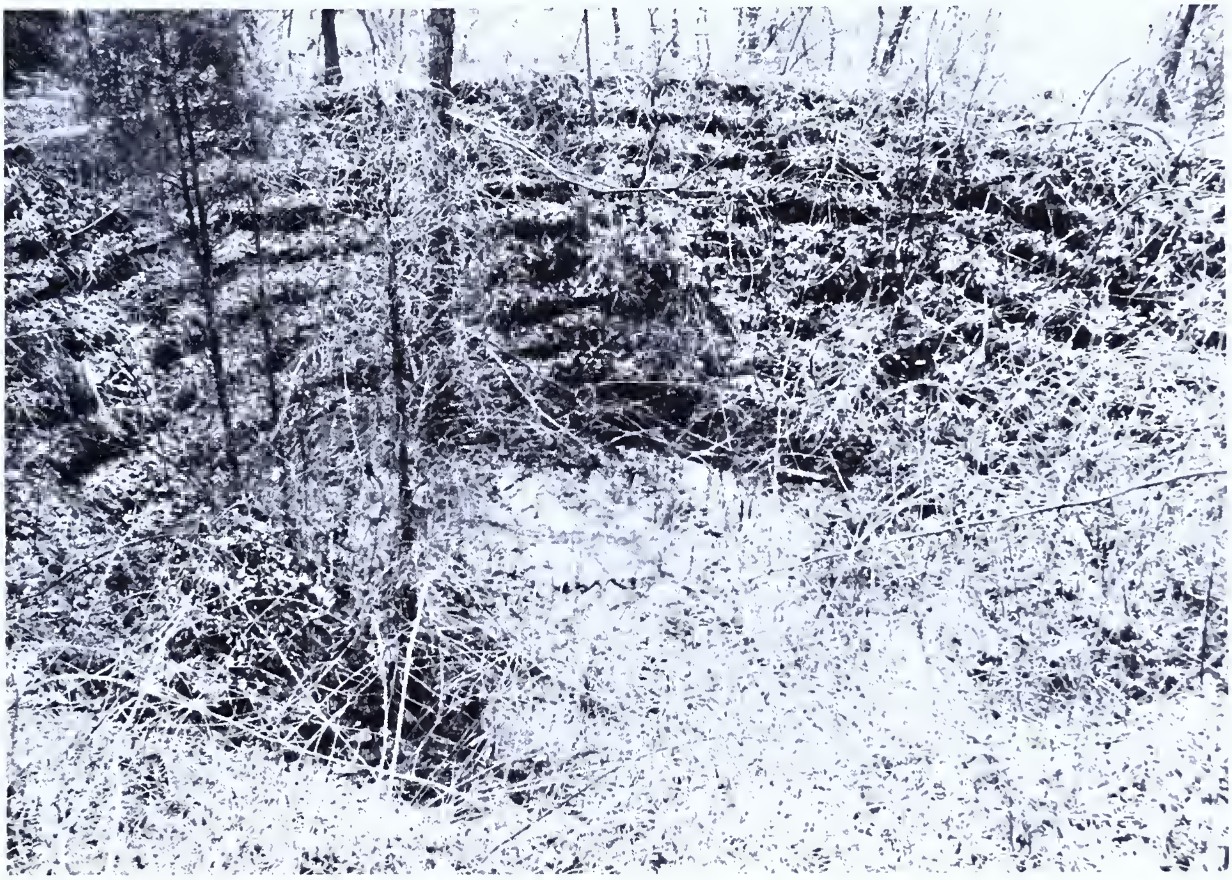
REMARKS: Black Barren Spring is located in the midst of a "serpentine barren" and flows from fractures in the



underlying rock, serpentinite (a magnesium-rich metamorphic rock derived from pyroxenite and peridotite, usually green in color).

In 1877 Black Barren Spring was advertised for its medicinal value; at that time it was associated with a large hotel that was located about 1,000 feet to the west. Today, the hotel is gone, and the spring and its large cement amphitheater are almost hidden by trees and underbrush; oak and cedar trees are growing from the floor of the spring. The scene resembles the ruins of a lost civilization in a jungle.

REFERENCE: Frazer, Persifor, Jr. (1880), *The geology of Lancaster County,* Pennsylvania Geological Survey, 2nd ser., Report CCC, 350 p.



## 509. BLACK BARREN SPRING *(continued)*

Small serpentinite quarry 0.3 mile northeast of Black Barren Spring.

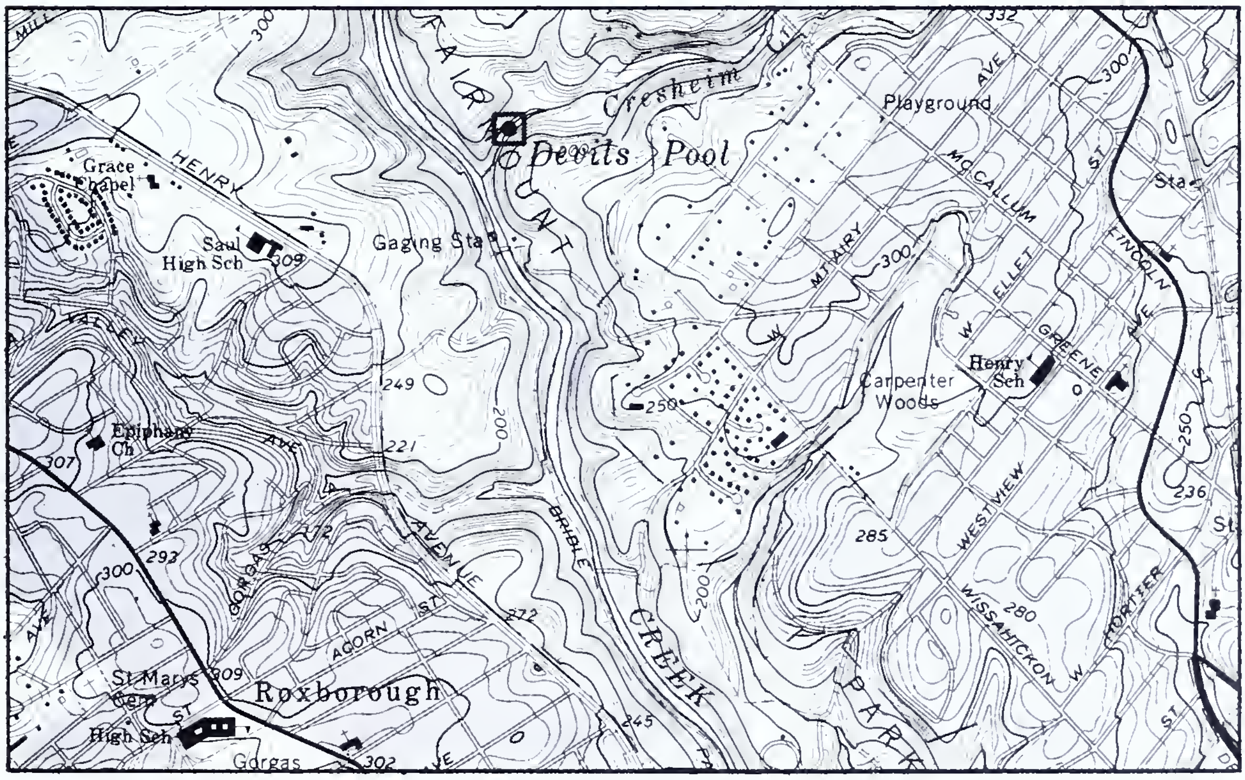
# 510. DEVILS POOL

COUNTY: Philadelphia CITY: Philadelphia

QUADRANGLE: Germantown

LOCATION: On Cresheim Creek, near its intersection with Wissahickon Creek, within Fairmount Park.

REMARKS: Following zones of weak rock, the water has cut down through the rock to form this small gorge; the force of the water flowing over the falls through time has caused erosion of the rock beneath the falls and has formed the large depression known as the Devils Pool or the **Devils Plunge Pool**. The pear-shaped pool is about 30 feet deep and approximately 30 feet wide. Large outcrops of mica schist and quartzite (Wissahickon Formation, Lower



## 510. DEVILS POOL *(continued)*

Paleozoic age) surround the pool; weathering has decomposed the mica schist, and mica flakes may be seen flashing in the sunlight. Garnet, occurring as small individual crystals in the schist, has a distinctive deep-red color.

REFERENCES:

Goodwin, B. K. (1964), *Guidebook to the geology of the Philadelphia area,* Pennsylvania Geological Survey, 4th ser., General Geology Report 41, 189 p.

Maser, B. (1979), personal communication, Philadelphia, Pa.

NOTES:

PIEDMONT PROVINCE

PIEDMONT UPLANDS SECTION

# 511. RIVER HILLS

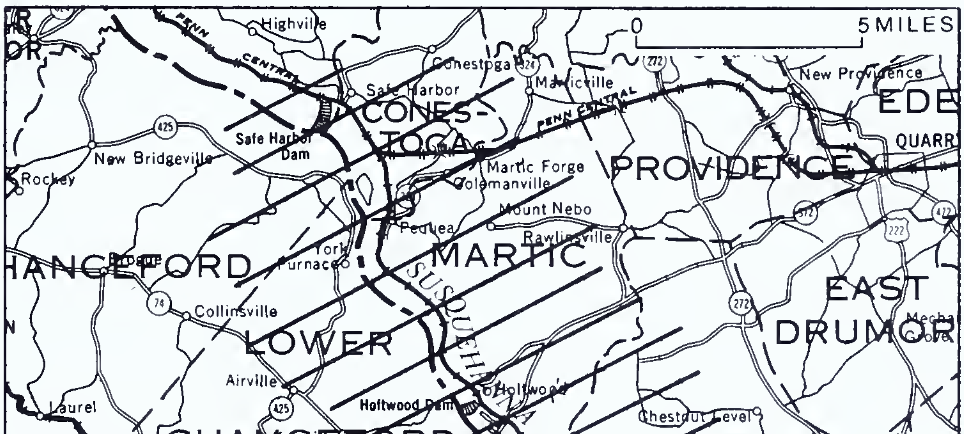
COUNTIES: York and Lancaster

TOWNSHIPS: Conestoga, Martic, Drumore, and Fulton (Lancaster County); Chanceford, Lower Chanceford, and Peach Bottom (York County)

QUADRANGLES: Safe Harbor, Conestoga, Airville, Holtwood, Wakefield, Delta, and Conowingo Dam

LOCATION: Several miles to the east and west of the lower Susquehanna River between Safe Harbor and the Mason and Dixon Line.

REMARKS: There is a very distinct and scenic rolling and dissected upland topography developed on the rocks (schists of the Wissahickon Formation and Peters Creek Schist, Lower Paleozoic age) adjacent to the river. This topography was so different that the area became known locally as the "river hills."



## 511. RIVER HILLS *(continued)*

# 512. SCULPTURED ROCKS

COUNTY: Lancaster TOWNSHIP: Conestoga

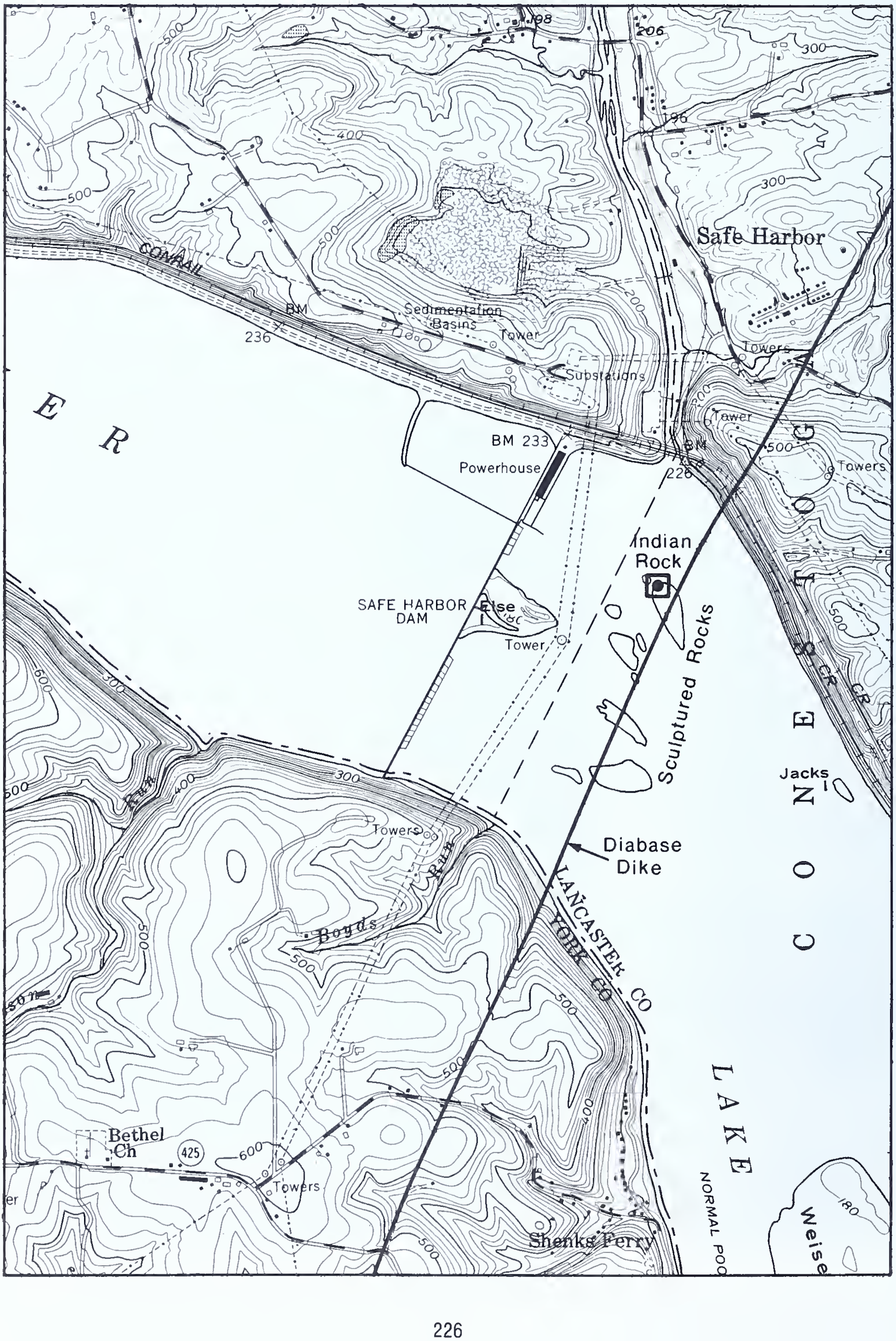
QUADRANGLE: Safe Harbor

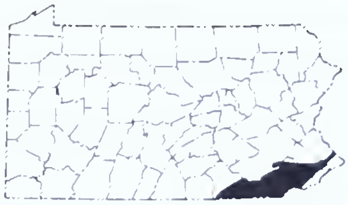
LOCATION: In the Susquehanna River, adjacent to the Safe Harbor Dam, about 1 mile southwest of the village of Safe Harbor.

REMARKS: The famous Sculptured Rocks are outcrops of mica schist (Wissahickon Formation, Lower Paleozoic age) that contain carvings by early inhabitants; one of these outcrops has been known as **Indian Rock** (513) since the 1870's. They derive their name from the inscriptions or hieroglyphics carved on them. The carved figures have been largely destroyed by normal rock weathering and vandalism. A few miles south of the Maryland line along the river are similar inscriptions on rocks called the Bald Friars Sculptured Rocks. It is thought that the two areas of hieroglyphics are part of a connected story.

In 1877 when Dr. Persifor Frazer, Jr., of the Pennsylvania Geological Survey, studied this area, he did not photograph the Lancaster County Sculptured Rocks. He did, however, use whitewash to outline

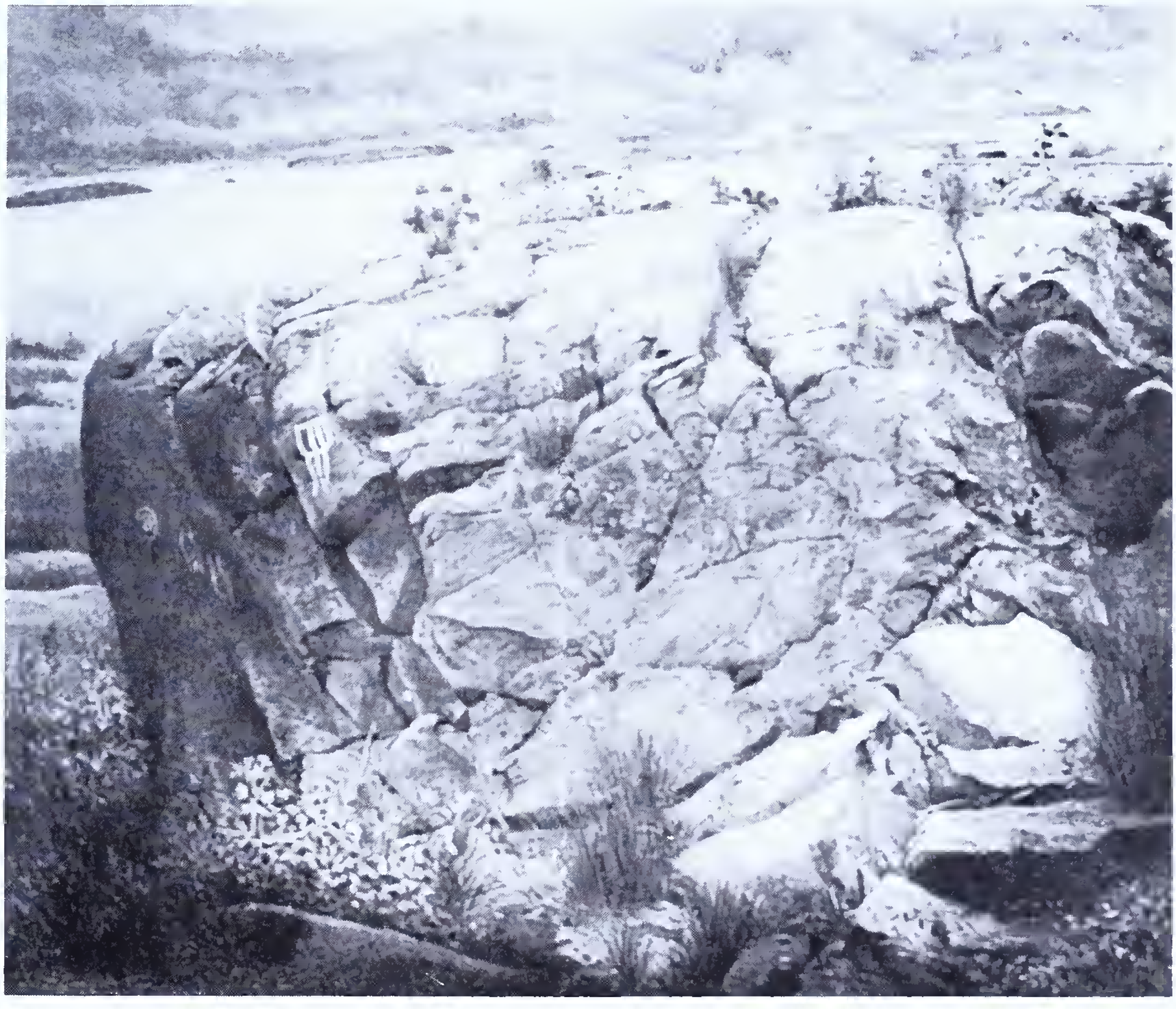
## 512. SCULPTURED ROCKS *(continued)*





the figures on the Bald Friars Rocks and took photographs of them.

REFERENCE: Frazer, Persifor, Jr. (1880), *The geology of Lancaster County,* Pennsylvania Geological Survey, 2nd ser., Report CCC, 350 p.



BALD FRIARS SCULPTURED ROCKS
(in the Susquehanna River about 1½ miles south of the Pennsylvania-Maryland line; looking southeast)
(From Frazer, 1880, Plate III)

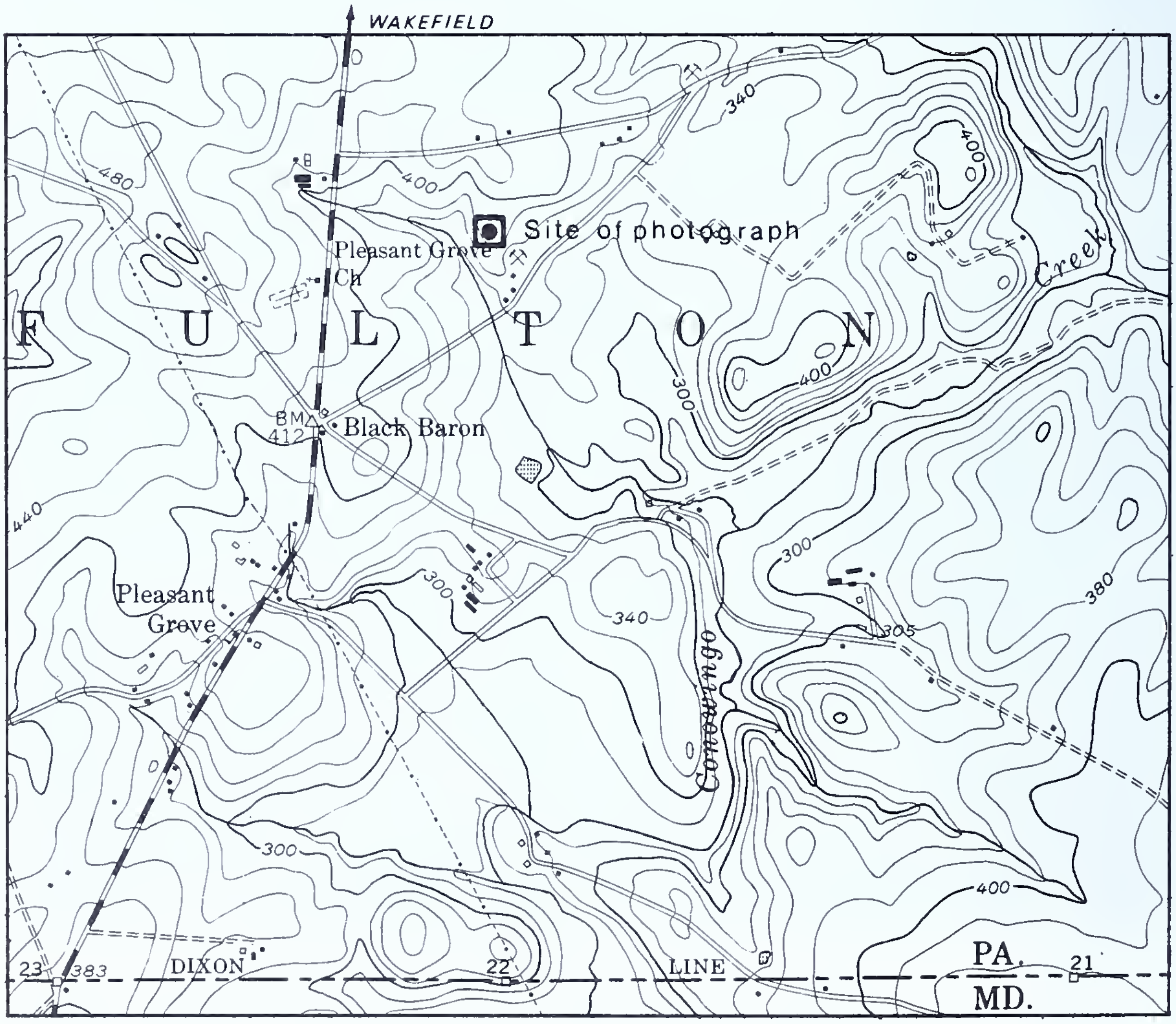
# 514. SERPENTINE BARRENS

COUNTIES: Lancaster and Chester TOWNSHIPS: West Nottingham (Chester County); Fulton (Lancaster County)

QUADRANGLES: Rising Sun and Conowingo Dam

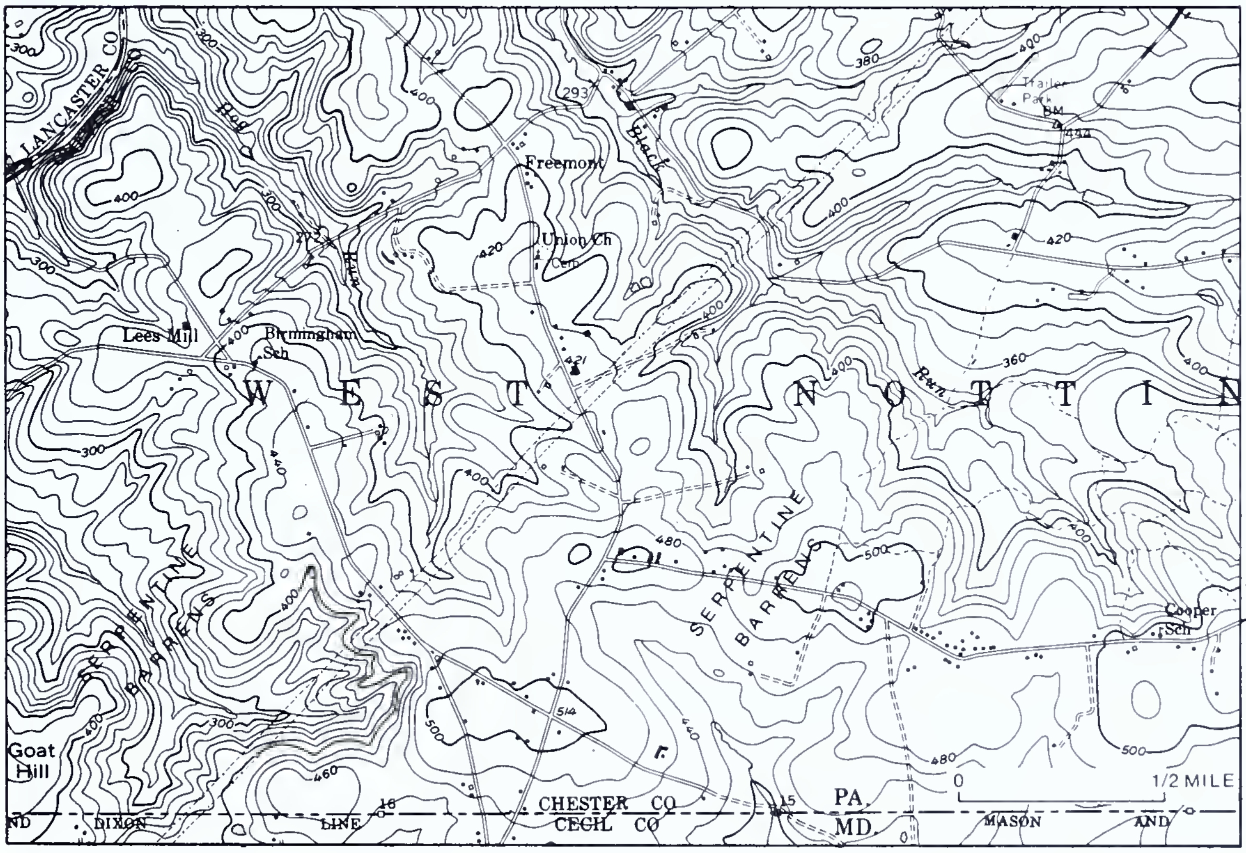
LOCATION: In Chester County approximately 2 miles southwest of the village of Nottingham; in Lancaster County east and southeast of the village of Barren.

REMARKS: In southern Lancaster and Chester Counties scattered and isolated outcrops of the rock serpentinite are responsible for the "so-called" serpentine barrens.



The primary mineral, serpentine, is composed of aluminum, magnesium, and silica and contains significant trace amounts of nickel and chromium, which appear to support a specialized flora, hence the existence of a "barren." The barrens are characterized

SERPENTINE BARREN, FULTON TOWNSHIP, LANCASTER COUNTY



## 514. SERPENTINE BARRENS *(continued)*

by the absence of most of the common forest species that are dominant elsewhere in the region and contain instead many rare species (for Pennsylvania), including the long hairy-field chickweed, pitch pine, and prairie grass.

Individual "barrens" are known locally by different names. Some of the more common ones are **State Line barren, Goat Hill barren, Nottingham barren, Britons Quarry barren, Unionville barren, and Newlin Township barren**. Actually one or more of these names may apply to the same area.

NOTES:

# SPRINGS IN PENNSYLVANIA

A spring is defined as a place where groundwater flows naturally from rock or soil onto the land surface or into a body of surface water. Springs were extremely important to the early Pennsylvania settler; they served as the primary water supply for many colonial villages throughout the Commonwealth. The importance of the spring to the community is apparent from the numerous localities in Pennsylvania named for the springs found and used in those areas: Chester Springs, Buffalo Springs, Alexander Springs, Spring Garden, Spring City, Beaver Springs, and so forth. Even today, many household water supplies, industrial supplies, and public groundwater supplies are derived from springs.

It has been said that no two springs are alike. A spring may have a constant discharge, or the discharge may vary. A spring can be permanent or seasonal. The temperature of the water may be near the average annual air temperature, or it may be below or above it. The yield of a spring may be a trickle or tens of thousands of gallons per minute. The springs in Pennsylvania reflect all of these variables and more.

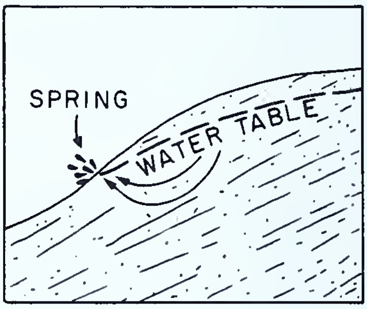
Springs in the United States have been classified by the U.S. Geological Survey with respect to the quantity of water discharged. The classification is as follows:

| *Magnitude* | *Discharge* |
|---|---|
| First | 44,880 gallons per minute or more (100 second-feet) |
| Second | 4,488 to 44,879 gallons per minute (10 second-feet) |
| Third | 448.8 to 4,487 gallons per minute (1 second-foot) |
| Fourth | 100 to 448.7 gallons per minute |
| Fifth | 10 to 99 gallons per minute |
| Sixth | 1 to 9 gallons per minute |
| Seventh | 1 pint to 0.9 gallon per minute |
| Eighth | Less than 1 pint per minute (less than 180 gallons per day) |

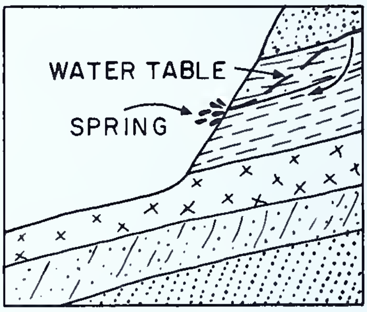
There are no first magnitude springs in Pennsylvania. There are, however, at least 15 springs of second magnitude and dozens of springs of third and fourth magnitudes. The highest yielding springs are located in central and southeastern Pennsylvania and are associated with carbonate rock aquifers.

Generally speaking, springs may be grouped into several types and combinations. The diagrams below illustrate a few of the more common types.

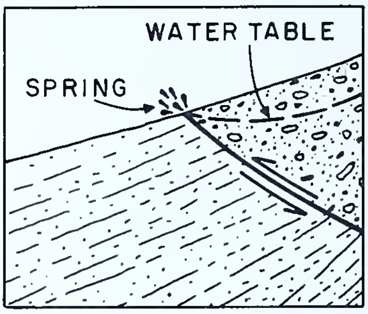
*Depression springs* are formed where the water table reaches the land surface due to an abrupt change in the topography. A local flow system is created and a spring forms at the local discharge area.



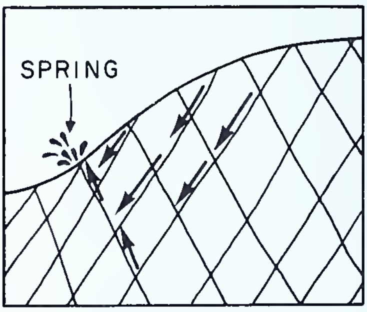
*Contact springs* may occur where permeable rock units overlie rocks of much lower permeability. A contact between two rock types is often marked by a line of springs.



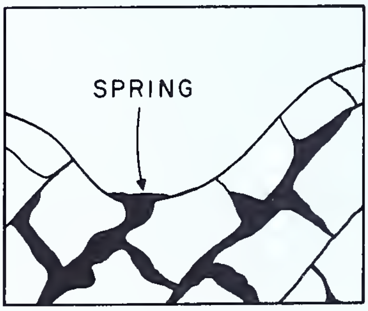
*Fault springs* may result where an impermeable rock unit is faulted against an aquifer. The faulting can form a boundary to groundwater movement, and the water in the aquifer is forced to discharge. A fault is often marked by a line of springs.



*Joint springs* may occur where a rock of low permeability contains interconnecting joint fractures. The movement of groundwater is through these fractures, and, where they intersect the land surface at low elevations, springs may form.



*Sinkhole springs* exist in areas of carbonate bedrock where the groundwater, under artesian pressure, rises to the surface at the bottom of a sinkhole. The groundwater moves through interconnected solution channels (usually joint or bedding openings widened by solution of the carbonate rock) until it discharges to the surface.



A thorough search of the geological literature and topographic maps of Pennsylvania by the authors, as well as personal communications to the authors by various people, has resulted in the following list of *named* springs in Pennsylvania. The authors welcome any additional information on these or on named springs not included in the list.

## SPRINGS IN PENNSYLVANIA

| *Spring* | *County* | *Yield (gallons per minute)* | *Data source* |
|---|---|---|---|
| Cold Springs | Adams | — | 15 |
| Gettysburg Spring | do. | — | 7, p. 253 |
| Iron Spring | do. | 1 | 4 |
| Katalysine Spring | do. | — | 15 |
| Knob Springs | do. | — | 15 |
| Lippencot Springs | do. | — | 15 |
| Poplar Spring | do. | 6 | 6 |
| Spanglers Spring | do. | — | 15 |
| Stillhouse Spring | do. | — | 30 |
| York Sulphur Spring | do. | 3 | 6 |
| Allegheny Spring | Allegheny | — | 16 |
| Wildwood Spring | do. | — | 16 |
| Parkers Spring | Armstrong | — | 16 |
| Frankfort Springs | Beaver | 4 | 6, 16 |
| Adams White Sulphur Springs | Bedford | — | 27, p. 345 |
| Addison Ridge Chalybeate Springs | do. | — | 27, p. 346 |
| Bedford Springs | do. | — | 6; 27, p. 339 |
| Black Spring | do. | — | 15 |
| Bubbling Spring | do. | 100 | 6 |
| Chalybeate Spring | do. | — | 27, p. 343 |
| Crystal Spring | do. | — | 25 |
| Hafer Spring | do. | — | 27, p. 344 |
| Indian Springs | do. | — | 15 |
| Living Water Spring | do. | 1,400 | 6 |
| Magnesia Iron Spring | do. | 30 | 6; 27, p. 341 |
| Magnesium (Magnesia) Spring | do. | 30 | 6; 27, p. 339 |
| Maria Spring | do. | 75 | 25 |
| A. M. Mays Springs | do. | — | 27, p. 344 |
| Potter Creek Spring | do. | 25 | 25 |

| *Spring* | *County* | *Yield (gallons per minute)* | *Data source* |
|---|---|---|---|
| Reed and Lyon White Sulphur Spring | Bedford | 5 | 6; 27, p. 343 |
| Rob Spring | do. | — | 15 |
| Spring Meadow (Reynoldsdale) Spring | do. | 1,600 | 6, 22 |
| Sulphur Spring | do. | 30 | 6; 27, p. 340 |
| Three Springs | do. | 100 | 25 |
| White Sulphur Spring | do. | 5 | 6; 27, p. 343 |
| Wolfords White Sulphur Spring | do. | 5 | 27, p. 345 |
| Big Spring | Berks | 2,000 | 6 |
| Gold Spring | do. | 70 | 9, p. 107 |
| Gring Spring | do. | — | 9, p. 106 |
| Kutztown Borough Spring | do. | 600 | 6 |
| Mammoth Spring | do. | 700 | 6 |
| Moselem Springs | do. | — | 25 |
| Myers Canning Company | do. | 500 | 6 |
| Pavilion | do. | — | 9, p. 106 |
| Peters Creek Spring | do. | 2,000 | 6 |
| Pilger Run Spring | do. | <10 | 24 |
| Wyomissing Spring | do. | — | 9, p. 106 |
| Yost Spring | do. | — | 9, p. 106 |
| Arch Spring | Blair | 8,000 | 6, 8 |
| Big Spring | do. | 100 | 6 |
| Big Spring | do. | 2,330 | 31 |
| Big Springs | do. | 3,700 | 6 |
| Burket Stake Spring | do. | 100 | 31 |
| Cold Spring | do. | 400 | 6 |
| Flowing Spring | do. | 200 | 6 |
| McAllister Spring | do. | 1,500 | 22 |
| Pennsylvania Fish Commission Spring | do. | 1,500 | 6 |
| Prince Gallitzin Spring | do. | — | 15 |
| Roaring Spring | do. | 4,500 | 6, 8 |
| Weynant Spring | do. | — | 6 |
| Yellow Spring | do. | — | 15 |
| Railroad Springs | Bradford | 50 | 6 |
| Aquetong Spring | Bucks | — | 15 |
| Hellerman Spring | do. | — | 9, p. 119 |
| Ingham Spring | do. | 2,000 | 6 |
| Jones Spring | do. | — | 9, p. 119 |
| Kern Spring | do. | — | 9, p. 118, 119 |

| *Spring* | *County* | *Yield (gallons per minute)* | *Data source* |
|---|---|---|---|
| Kerr Spring | Bucks | 200 | 6 |
| Small Spring | do. | — | 9, p. 119 |
| Springtown Spring | do. | 100 | 25 |
| Cresson Springs | Cambria | — | 16 |
| Memorial Spring | Cameron | — | 19 |
| Sizerville Spring | do. | — | 16 |
| Big Spring | Carbon | — | 3 |
| Indian Spring | do. | — | 15 |
| Penn Springs | do. | — | 15 |
| Able Spring | Centre | 115 | 31 |
| Axemann Spring | do. | 900 | 6 |
| Bathgate Spring | do. | 500 | 6 |
| Bellefonte (Big) Spring | do. | 8,000 | 6, 8, 13 |
| Benner (Rock) Spring | do. | 4,000 | 6, 13 |
| Big Sterling Spring | do. | 75 | 6 |
| Blue (Shutgart) Spring | do. | 3,500 | 6 |
| Coburn Spring | do. | 2,400 | 34 |
| Crystal Spring | do. | 2 | 31 |
| Elk Creek Spring | do. | — | 34 |
| Fishermans Paradise Spring | do. | 3,000 | 34 |
| Forked Spring | do. | 4,000 | 22, 34 |
| Herdner Spring | do. | — | 15 |
| Horse Path Spring | do. | — | 15 |
| Kelly Spring | do. | 7,000 | 6, 13 |
| McKinney Spring | do. | — | 15 |
| Paradise Spring | do. | — | 34 |
| Penns Cave Spring | do. | 4,000 | 6, 8 |
| Pine Hill Spring | do. | 670 | 25 |
| Rising Spring | do. | 6,000 | 6 |
| Rock Spring | do. | 1,200 | 6, 13 |
| Rock Spring | do. | 4,000 | 6 |
| Shutgart (Blue) Spring | do. | 3,500 | 6 |
| Spring Bank | do. | 730 | 34 |
| Sterling Spring | do. | 85 | 34 |
| Thompson Spring | do. | 3,000 | 6 |
| Thorton Spring | do. | — | 25 |
| Weaver Spring | do. | 5,400 | 34 |
| Yellow Springs (Chester Springs) | Chester | — | 16 |
| Ebenezer Spring | Clarion | — | 18 |
| Huefner Spring | do. | 35 | 6 |
| Slocum Spring | do. | 45 | 6 |

| *Spring* | *County* | *Yield (gallons per minute)* | *Data source* |
|---|---|---|---|
| Mineral Springs | Clearfield | — | 25 |
| Big Rock Spring | Clinton | 10 | 25 |
| Big Spring | do. | 5,000 | 6, 25 |
| Cedar Spring | do. | 1,400 | 6, 13 |
| Crystal Spring | do. | 3,500 | 6, 13 |
| Gardner Spring | do. | 2,000 | 22 |
| Hemlock Spring | do. | 10 | 15 |
| Kremmerer Spring | do. | 300 | 6 |
| Lamar Spring | do. | 1,100 | 6 |
| Lamey Spring | do. | 950 | 6 |
| Loganton Sulphur Spring | do. | 20 | 6 |
| Long Spring | do. | 550 | 6 |
| McLane Spring | do. | 650 | 6, 13 |
| Ruhl Spring | do. | 11,000 | 6, 8, 13 |
| Sand Spring | do. | — | 15 |
| Seven Spring | do. | 11,000 | 6, 8 |
| Steel Spring | do. | 2,000 | 6 |
| Tea Spring | do. | 21 | 6, 8 |
| Tylersville Spring | do. | 13,000 | 6, 8 |
| Valley Dairy Spring | do. | 4,000 | 6 |
| Washington Furnace Spring | do. | 1,800 | 6, 13 |
| Gensel Spring | Columbia | 10 | 33 |
| Hoffman (Lower) Spring | do. | 14 | 33 |
| Hoffman (Upper) Spring | do. | 14 | 33 |
| Ponce de Leon Spring | Crawford | — | 15 |
| Shelmadine Springs | do. | — | 15 |
| Alexander Spring | Cumberland | 1,100 | 6 |
| Baker Spring | do. | 1,800 | 1 |
| Big Spring | do. | 12,500 | 6, 8 |
| Boiling Springs | do. | 11,500 | 6, 8 |
| Bucher Spring | do. | 750 | 6 |
| Carlisle Spring | do. | — | 16 |
| Cool Spring | do. | 750 | 6 |
| Doubling Gap Springs | do. | — | 25 |
| Dykeman (Shippensburg) (Ainsworth) Spring | do. | 900 | 6; 7, p. 251; 22 |
| Eichelberger Spring | do. | 1,100 | 6 |
| Green Spring | do. | 1,300 | 6 |
| Hidden Spring | do. | 30 | 6 |
| Huntsdale Hatchery Springs | do. | — | 6, 8 |
| Mount Holly Spring | do. | 10 | 9, p. 152 |

| *Spring* | *County* | *Yield (gallons per minute)* | *Data source* |
|---|---|---|---|
| Mount Rock Spring | Cumberland | 1,000 | 6 |
| Mount Rock Spring (North) | do. | 750 | 6 |
| Silver Spring | do. | 1,900 | 6 |
| Spring Lake Spring | do. | 350 | 6 |
| Trindle Spring | do. | 850 | 6 |
| Trindle Spring | do. | 730 | 1 |
| Whisky Spring | do. | — | 15 |
| Minnich Spring | Dauphin | — | 23 |
| Spring Creek (Derry) Springs | do. | 10,000 | 25 |
| Carnocker Spring | Elk | — | 15 |
| Wolf Run Spring | do. | — | 15 |
| Corry Artesian Fountain | Erie | — | 16 |
| Cool Spring | Fayette | 100 | 6 |
| Fayette Spring | do. | 5 | 26, p. 70 |
| Washington Spring (historic) | do. | 5 | 8 |
| Red Spring | Forest | — | 15 |
| Big Spring | Franklin | 2,500 | 2 |
| Browns Spring (historic) | do. | — | 25 |
| Buena Vista Springs | do. | — | 9, p. 174 |
| Chestnut Spring | do. | 10 | 8, p. 392 |
| Church Hill Spring | do. | 1,320 | 2 |
| Cold Springs | do. | — | 15 |
| Cove Mountain Spring | do. | 10 | 25 |
| Crawford Spring | do. | — | 15 |
| Fall Spring | do. | — | 9, p. 171 |
| Falling Spring | do. | 1,850 | 2, 6 |
| Falling Springs | do. | 900 | 6 |
| Graffenburg Spring | do. | — | 7, p. 252 |
| Hoover Spring | do. | 500 | 2, p. 66 |
| Indian Spring | do. | 10 | 6, 7 |
| Lecron Spring | do. | 260 | 2, p. 66 |
| Monterey Spring | do. | 40 | 7, p. 249 and 347 |
| Moss Spring | do. | 650 | 2, 6 |
| Muddy Run Spring | do. | — | 15 |
| Nunnery Spring | do. | 1,190 | 2, p. 66 |
| Oak Spring | do. | 300 | 2, 6 |
| Pearl (Pearl-of-the-Park) Spring | do. | 10 | 6, 7, 8 |
| Pinola Springs | do. | 1,650 | 2 |
| Rocky Spring | do. | 1,600 | 2, 6 |
| Rocky Spring | do. | 175 | 32 |

| *Spring* | *County* | *Yield (gallons per minute)* | *Data source* |
|---|---|---|---|
| Tarburner Spring | Franklin | 10 | 8, p. 392 |
| Tomstown Pump | do. | 20 | 32 |
| Trail Springs | do. | 6 | 32 |
| Travelers Spring | do. | 10 | 8, p. 392 |
| Big Spring | Fulton | 500 | 6 |
| Fritz Spring | do. | — | 15 |
| Gum Spring | do. | 20 | 15 |
| House Spring | do. | — | 15 |
| Oak Spring | do. | — | 15 |
| Richmond Spring | do. | — | 15 |
| Sand Spring | do. | — | 15 |
| Birmingham Cave Spring | Huntingdon | — | 31 |
| Captain Jacks Spring | do. | — | 18 |
| Chestnut Spring | do. | — | 8 |
| Diehl Spring | do. | — | 15 |
| Double Spring | do. | 450 | 6 |
| Hundred Springs | do. | 2,800 | 6 |
| Keith Spring | do. | — | 15 |
| Mason Spring | do. | 60 | 6 |
| Near Tippery Spring | do. | — | 31 |
| Prices Spring | do. | 690 | 6 |
| Ross Spring | do. | — | 8 |
| Saltillo Springs | do. | — | 16 |
| Spruce Creek Spring | do. | — | 31 |
| Tippery Cave Spring | do. | — | 31 |
| Warm Spring | do. | 300 | 6 |
| Granny Coon Spring | Indiana | — | 15 |
| Blue Spring | Juniata | — | 3 |
| Cedar Spring | do. | — | 15 |
| Sand Spring | Lackawanna | — | 15 |
| Big Spring | Lancaster | 50 | 6 |
| Black Barren Spring | do. | — | 7 |
| Black Rock Spring | do. | 5 | 8 |
| Donegal Springs | do. | 1,600 | 6 |
| Ephrata Springs | do. | — | 7, p. 253 |
| Florin (Charles) Spring | do. | 1,300 | 6 |
| Lebanon Pumping Station Spring | do. | 5 | 25 |
| Lititz (Lititz Big) Spring | do. | 1,200 | 6; 7, p. 254 |
| Rock Spring (Seven Springs) | do. | 10 | 7 |
| Rocky Spring | do. | 50 | 6, 7 |

| *Spring* | *County* | *Yield (gallons per minute)* | *Data source* |
|---|---|---|---|
| Williamson (Park) Spring | Lancaster | 20 | 25 |
| Pulaski Spring | Lawrence | — | 16 |
| Annville Water Company Spring | Lebanon | 5,000 | 14 |
| Buck-Shot Spring | do. | 10 | 25 |
| Buffalo Spring | do. | 50 | 15 |
| Mollies Spring | do. | 10 | 25 |
| Penryth Spring | do. | 800 | 6 |
| Russian Spring | do. | — | 17 |
| Sand Spring | do. | 50 | 25 |
| St. Joseph Springs | do. | — | 17 |
| Schaefferstown (Walnut) Spring | do. | 10 | 25 |
| Crystal Spring | Lehigh | 2,700 | 6, 35 |
| 15th Street Spring | do. | 450 | 6, 35 |
| Fish Hatchery Spring | do. | 1,200 | 6, 35 |
| Helfrichs Spring | do. | 950 | 6, 35 |
| Lechauweki Spring | do. | — | 35 |
| Lehigh Park Spring | do. | 20 | 6 |
| Mosser Spring | do. | 75 | 6, 35 |
| Overlook Springs | do. | 20 | 25 |
| Poorhouse Spring | do. | 170 | 6, 35 |
| Sand Springs | do. | 80 | 35 |
| Schantz Spring | do. | 4,400 | 6, 35 |
| Trexler Spring | do. | 125 | 6, 35 |
| Pocono Spring | Luzerne | — | 15 |
| Cummings Spring | Lycoming | — | 15 |
| Dunwoody Spring | do. | 5 | 25 |
| Enchanted (Nipono) Spring | do. | 18,000 | 6, 8 |
| Hollow Spring | do. | 200 | 6 |
| Nipono (Enchanted) Spring | do. | 18,000 | 6, 8 |
| Sand Spring | do. | — | 15 |
| Silver Springs | do. | — | 15 |
| Alexander Springs | Mifflin | — | 15 |
| Chestnut Spring | do. | — | 15 |
| Havice Spring | do. | — | 15 |
| Mammoth Spring | do. | 14,000 | 6, 8 |
| Swarey Spring | do. | 1,250 | 6 |
| White Pine Spring | do. | — | 15 |
| Yoder Spring | do. | 1,350 | 6 |

| *Spring* | *County* | *Yield (gallons per minute)* | *Data source* |
|---|---|---|---|
| Octave Spring | Monroe | — | 15 |
| Sand Spring | do. | — | 15 |
| Stroudsburg (Water Supply Company) Spring | do. | 650 | 6 |
| Bill Warner Spring | do. | — | 15 |
| Roscommon Spring | Monroe(?) | — | 16 |
| Ambler (Water Company) Spring | Montgomery | 600 | 6 |
| Althofer Spring | Northampton | 250 | 9, p. 221 |
| Bethlehem Steel Company Spring | do. | 1,800 | 6 |
| Handelong Spring | do. | 350 | 9, p. 221 |
| Horn Springs | do. | — | 15 |
| Muffley Spring | do. | 200 | 6 |
| Bloody Spring (historic) | Northumberland | — | 24 |
| Big Spring | Perry | 40 | 15 |
| Falling Spring | do. | — | 28 |
| Midway Warm Spring | do. | — | 23 |
| Sulphur Springs | do. | — | 15 |
| Warm Springs | do. | — | 28, 29 |
| Dingman Spring | Pike | — | 15 |
| Cherry Springs | Potter | — | 15 |
| Fountain Springs | Schuylkill | — | 25 |
| Bear Spring | Snyder | — | 15 |
| Bear Spring | do. | — | 15 |
| Beaver Springs | do. | — | 15 |
| Cold Spring | do. | — | 15 |
| Rock Springs | do. | — | 15 |
| Sheep Pen Spring | do. | — | 15 |
| Baughman Spring | Somerset | 167 | 15 |
| Beck Spring | do. | 200 | 6 |
| Big Spring | do. | 175 | 5, 6 |
| Blue Hole Spring | do. | — | 5 |
| Findley Spring | do. | 40 | 6 |
| Kooser Spring | do. | 100 | 6 |
| Paterson Spring | do. | — | 15 |
| Van Dyke Spring | do. | 30 | 6 |
| Half Way Spring | Susquehanna | 2 | 6; 11, p. 264 |
| Salt Springs | do. | 5 | 8 |
| Spencer Spring | do. | 9 | 6; 11, p. 264 |

| *Spring* | *County* | *Yield (gallons per minute)* | *Data source* |
|---|---|---|---|
| Susquehanna Spring | Susquehanna | — | 16 |
| Blossburg Springs | Tioga | — | 16 |
| Matson Spring | do. | — | 15 |
| Orchard Spring | do. | — | 15 |
| Reynolds Spring | do. | — | 22 |
| Boiling Spring | Union | 25 | 25 |
| Chambers Spring | do. | 300 | 6 |
| Cinder Pile Spring | do. | — | 15 |
| Little Bubbler Spring (see Boiling Spring) | do. | 1-5 | 25 |
| McKean Spring | do. | 40 | 12 |
| Potpie Spring | do. | — | 15 |
| Sand Spring | do. | 60 | 12 |
| Tea Spring | do. | 4 | 8, 12 |
| Thompson Spring | do. | 200 | 12 |
| White Springs | do. | — | 15 |
| R. B. Winter Spring (see Boiling Spring) | do | 1-5 | 25 |
| Ethel Spring | Westmoreland | 25 | 6 |
| Eureka Springs | do. | — | 16 |
| Grove Run Spring | do. | 5 | 15 |
| Pythian Park Spring | York | 1 | 9, p. 239 |

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# WATERFALLS IN PENNSYLVANIA

Pennsylvania's landscape is the result of a continuing conflict in nature. There is a constant struggle between the geologic forces that build the land and those that wear it down. Almost all scenic geologic features in Pennsylvania have been created from this never-ending battle.

The waterfall is an excellent illustration of this struggle of natural geologic processes. The waterfall sculptures the rocks into some of the Commonwealth's most breathtaking scenery.

Waterfalls often are grouped into three classes or types based on their origin: (1) waterfalls whose origin is due to the different resistance of the rocks to the action of running water; (2) waterfalls whose origin is due to geologic factors other than the resistance of the rocks (an example of this type is a waterfall created by a valley glacier that has scooped out a river valley, leaving small tributary streams "hanging"); and (3) waterfalls created by the formation of calcium carbonate (dripstone) around the edge of a pool in a limestone cave. Pennsylvania's waterfalls occur as all three types and range in free fall from a few inches to a sheer drop of over 100 feet and in volume of water from a trickle to that of Bushkill Falls, often referred to as the "Niagara Falls of Pennsylvania."

The following list of waterfalls in Pennsylvania has been compiled by the authors from many information sources. The authors realize that it is not complete and welcome comments, photographs, and additions.

## WATERFALLS IN PENNSYLVANIA

| *Name* | *Height (feet)* | *County* | *Topographic map (7½-minute)* | *Physiographic province and section* |
|---|---|---|---|---|
| Homewood Falls | 15 | Beaver | Beaver Falls | Appalachian Plateaus province<br>Pittsburgh Plateaus section |
| Blair Falls | — | Blair | Blue Knob | Valley and Ridge province<br>Appalachian Mountain section |
| Scudders Falls | — | Bucks | Pennington | Piedmont province<br>Triassic Lowland section |
| Buttermilk Falls | 20 | Carbon | Weatherly | Valley and Ridge province<br>Appalachian Mountain section |
| Chameleon Falls | 150 | do. | do. | do. |
| Hawk Falls | — | do. | Hickory Run | do. |
| Onoko Falls | 90 | do. | Weatherly | do. |
| Falls of French Creek (5) | 2; 3; 5; 4; 2 | Chester | Pottstown | Piedmont province<br>Triassic Lowland section |
| Rock Creek Falls | 15 | Crawford | Geneva | Appalachian Plateaus province<br>Glaciated section |
| Howard Falls | — | Erie | Edinboro North | do. |
| Creek Falls | — | Fayette | Dawson | Appalachian Plateaus province<br>Allegheny Mountain section |
| Cucumber Falls | 15 | do. | Fort Necessity | do. |
| Ohiopyle Falls | 10 | do. | Ohiopyle | do. |
| Weaver Falls | — | Huntingdon | Huntingdon | Valley and Ridge province<br>Appalachian Mountain section |
| Nay Aug Park Falls (2) | 5; 5 | Lackawanna | Scranton | do. |
| Conewago Falls | Small | Lancaster | York Haven | Piedmont province<br>Triassic Lowland section |

| *Name* | *Height (feet)* | *County* | *Topographic map (7½-minute)* | *Physiographic province and section* |
|---|---|---|---|---|
| Grant City Falls (Muddy Creek Falls) | 20 | Lawrence | Portersville | Appalachian Plateaus province<br>Glaciated Section |
| Quakertown Falls | 50 | do. | Campbell (Ohio-Pa.) | do. |
| Spillway Falls | 60 | do. | Portersville | do. |
| Adams Falls (Kitchen Creek Falls) | 25 | Luzerne | Red Rock | Appalachian Plateaus province<br>Allegheny High Plateaus section |
| Benjamin Reynolds Falls | 40 | do. | do. | do. |
| Cayuga Falls | 11 | do. | do. | do. |
| Conestoga Falls | 17 | do. | do. | do. |
| Delaware Falls | 37 | do. | do. | do. |
| Erie Falls | 47 | do. | do. | do. |
| Ganoga Falls | 100 | do. | do. | do. |
| Great Falls of the Lehigh (Lehigh Falls and Stoddartsville Falls) | 25 | do. | Pleasant View<br>Summit | Appalachian Plateaus province<br>Pocono Plateau section |
| Harrison Wright Falls | 27 | do. | Red Rock | Appalachian Plateaus province<br>Allegheny High Plateaus section |
| Huron Falls | 41 | do. | do. | do. |
| Kitchen Creek Falls (Adams Falls) | 25 | do. | do. | do. |
| Lehigh Falls (Stoddartsville Falls and Great Falls of the Lehigh) | 25 | do. | Pleasant View<br>Summit | Appalachian Plateaus province<br>Pocono Plateau section |
| Mohawk Falls | 37 | do. | do. | do. |
| Mohican Falls | 39 | do. | do. | do. |
| Murray Reynolds Falls | 16 | do. | do. | do. |
| Oneida Falls | 13 | do. | do. | do. |

| | | | | |
|---|---|---|---|---|
| Onondaga Falls | 15 | do. | do. | do. |
| Ozone Falls | 20 | do. | do. | do. |
| Powder Hole Falls | 30 | do. | Berwick | Valley and Ridge province<br>Appalachian Mountain section |
| F. L. Ricketts Falls | 10 | do. | Red Rock | Appalachian Plateaus province<br>Allegheny High Plateaus section |
| R. B. Ricketts Falls | 36 | do. | do. | do. |
| Seneca Falls | 12 | do. | do. | do. |
| Shawnee Falls | 30 | do. | do. | do. |
| Sheldon Reynolds Falls | 36 | do. | do. | do. |
| Tuscarora Falls | 47 | Luzerne | Red Rock | Appalachian Plateaus province<br>Allegheny High Plateaus section |
| Whirlpool Canyon Falls (4) | 3 (each) | do. | Wilkes-Barre East | Valley and Ridge province<br>Appalachian Mountain section |
| Wyandot Falls | 15 | do. | Red Rock | Appalachian Plateaus province<br>Allegheny High Plateaus section |
| Springfield Falls | 20 | Mercer | Mercer | Appalachian Plateaus province<br>Glaciated section |
| Buck Hill Falls | 100 | Monroe | Buck Hill Falls | Appalachian Plateaus province<br>Glaciated Low Plateaus section |
| Buttermilk Falls | 30 | do. | East Stroudsburg | Valley and Ridge province<br>Appalachian Mountain section |
| Clarke Falls | 15 | do. | do. | Appalachian Plateaus province<br>Pocono Plateau section |
| Lee Falls | 10 | do. | do. | do. |
| Marshalls Falls | 35 | do. | do. | Valley and Ridge province<br>Appalachian Mountain section |
| Paradise Falls | — | do. | Mount Pocono | do. |
| Resica Falls | 40 | do. | Bushkill | do. |
| Spruce Cabin Falls | — | do. | Skytop | Appalachian Plateaus province<br>Glaciated Low Plateaus section |

| *Name* | *Height (feet)* | *County* | *Topographic map (7½-minute)* | *Physiographic province and section* |
|---|---|---|---|---|
| Stoddartsville Falls (Lehigh Falls and Great Falls of the Lehigh) | 25 | Luzerne | Pleasant View Summit | Appalachian Plateaus province<br>Pocono Plateau section |
| Tobyhanna Falls | 10 | Monroe | Blakeslee | Appalachian Plateaus province<br>Pocono Plateau section |
| Twin Falls (2) | 5; 5 | do. | East Stroudsburg | Valley and Ridge province<br>Appalachian Mountain section |
| Bridal Veil Falls | — | Pike | Bushkill | do. |
| Bridal Veil Falls | — | do. | do. | do. |
| Brides Maids Falls | — | do. | do. | do. |
| Brides Maids Falls II | — | do. | do. | do. |
| Bushkill Falls (2) | 75; 50 | do. | do. | do. |
| Deer Leap Falls | 40 | do. | Lake Maskenozha | Appalachian Plateaus province<br>Glaciated Low Plateaus section |
| Dingmans Falls | 130 | do. | do. | Valley and Ridge province<br>Appalachian Mountain section |
| Factory Falls | 40 | do. | do. | Appalachian Plateaus province<br>Glaciated Low Plateaus section |
| Fulmer Falls | 50 | do. | do. | do. |
| High Falls | — | do. | Skytop | do. |
| High Falls | — | do. | Rowland | do. |
| High Falls | — | do. | Bushkill | Valley and Ridge province<br>Appalachian Mountain section |
| Indian Ladder Falls | 102 | do. | Skytop | Appalachian Plateaus province<br>Pocono Plateau section |
| Leavitt Falls | — | do. | do. | Appalachian Plateaus province<br>Glaciated Low Plateaus section |
| Little Falls | 8 | do. | Promised Land | Appalachian Plateaus province<br>Glaciated Low Plateaus section |

| | | | | |
|---|---|---|---|---|
| Pinchot Falls<br>(Sawkill Falls) | 60 | do. | Milford | Valley and Ridge province<br>Appalachian Mountain section |
| Raymondskill Falls (2) | 80; 45 | do. | do. | do. |
| Ridgeway Falls | — | do. | Rowland | Appalachian Plateaus province<br>Glaciated Low Plateaus section |
| Shohola Falls | 50 | do. | Shohola Falls | do. |
| Silver Thread Falls | 50 | do. | Lake Maskenozha | Valley and Ridge province<br>Appalachian Mountain section |
| Snow Hill Falls | 20 | do. | Skytop | Appalachian Plateaus province<br>Glaciated Low Plateaus section |
| Winona Falls | 20 | do. | Bushkill | Valley and Ridge province<br>Appalachian Mountain section |
| Cole Run Falls (2) | 12; 8 | Somerset | Kingwood | Appalachian Plateaus province<br>Allegheny Mountain section |
| Elklick Falls<br>(Laurel Falls) | 20 | do. | Markleton | do. |
| Klink Falls<br>(Laurel Falls) | 20 | do. | do. | do. |
| Laurel Falls | 20 | do. | do. | do. |
| Angel Falls | 20 | Sullivan | Hillsgrove | Appalachian Plateaus province<br>Allegheny High Plateaus section |
| Buttermilk Falls | 10 | do. | Shunk | do. |
| Cold Run Road Falls | 5 | do. | Eagles Mere | Appalachian Plateaus province<br>Allegheny High Plateaus section |
| Dry Run Falls | 10 | do. | Hillsgrove | do. |
| Dutchman Falls (2)<br>(Amber Falls) | 10; 30 | do. | Laporte | do. |
| Lewis Falls | 15 | do. | Red Rock | do. |
| Lincoln Falls | 30 | do. | Shunk | do. |
| Monarda Falls | 50 | do. | Eagles Mere | do. |
| Rainbow Falls | 20 | do. | do. | do. |
| Twin Falls | 15 | do. | Red Rock | do. |
| Wenonan Falls (3) | 10; 12; 20 | do. | Sonestown | do. |
| Windeck Falls | 10 | do. | Eagles Mere | do. |

| *Name* | *Height (feet)* | *County* | *Topographic map (7½-minute)* | *Physiographic province and section* |
|---|---|---|---|---|
| Falls of Devils Punch Bowl | 20 | Susquehanna | Susquehanna | Appalachian Plateaus province<br>Glaciated Low Plateaus section |
| Campbells Run Falls | 10 | Tioga | Tiadaghton | Appalachian Plateaus province<br>Allegheny High Plateaus section |
| Fall Brook Falls (2) | 10; 30 | do. | Gleason | do. |
| Buck Falls | 10 | Wayne | Starrucca | Appalachian Plateaus province<br>Glaciated Low Plateaus section |
| Darbytown Falls (Narrowsburg Falls) | 200 | do. | Narrowsburg | do. |
| Tanners Falls | 20 | do. | Aldenville | do. |
| Twin Falls (2) | 5; 5 | Wayne | Hancock | Appalachian Plateaus province<br>Glaciated Low Plateaus section |
| Wangum Falls | 35 | do. | Hawley | do. |
| Adams Falls | — | Westmoreland | Ligonier | Apalachian Plateaus province<br>Allegheny Mountain section |
| Buttermilk Falls (2) | 5; 5 | do. | Derry | do. |
| Buttermilk Falls (3) | 10; 15; 25 | Wyoming | Ransom | Appalachian Plateaus province<br>Glaciated Low Plateaus section |
| Evans Falls | — | do. | Noxen | do. |
| Duncan Run Falls | 20 | York | Holtwood | Piedmont province<br>Piedmont Uplands section |
| Indian Maiden Falls | 20 | do. | do. | do. |
| Wildcat Run Falls (3) | 15; 5; 5 | do. | Columbia West | do. |

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# GLOSSARY

*Anticline.* An upfold or arch in the rocks.

*Anticlinorium.* A major anticline or upfold composed of many smaller folds; an anticlinorium must be a large fold, several miles across.

*Axial plane.* An imaginary plane between the limbs of a fold that divides the fold as symmetrically as possible.

*Axis.* The intersection of the axial plane with the ground surface.

*Bed.* A layer of rock bounded at the top and bottom by planes of separation, or a layer of relatively uniform rock bounded by layers (beds) of recognizably different rocks. The thickness of a single bed may range from paper thinness to tens of feet. Note: At the time of deposition, beds normally have nearly horizontal attitudes, and younger beds are deposited on older beds. The present attitude of beds is therefore an indication of their deformation since deposition. Extreme deformation may lead to inverted sequences in which older beds lie on younger beds.

*Bedding.* In geology, the physical separation within sedimentary rocks along planes of stratification dividing rocks of similar or different lithologies.

*Bedding plane.* Not a true plane, but a more-or-less regular surface of separation between adjacent layers of rock. Note: Features of the rock, such as color banding, lamination, and shaly partings, which are parallel to the bedding planes, are commonly referred to as bedding.

*Breccia.* A rock made up of highly angular, coarse fragments; may be indicative of the presence of a fault or of sedimentary fragments not rounded by transportation.

*Cleavage.* The splitting of rocks along parallel surfaces of secondary origin.

*Cleavage plane.* A plane, of secondary origin, along which a rock cleaves.

*Conglomerate.* A cemented clastic rock containing rounded fragments corresponding in their grain sizes to gravel or pebbles.

*Contact.* A more-or-less regular surface where two formations are in contact with each other.

*Crest.* The top line of a mountain or hill.

*Cross fault.* See *Fault.*

*Diabase.* A dark-gray igneous rock composed of labradorite crystals partly included in pyroxene grains. Diabase forms if magma cools beneath the surface of the earth; it is generally medium grained. Basalt, which has the same composition as diabase, forms if the magma cools on the surface of the earth; it is generally fine grained.

*Dip.* The angle of inclination of a bed, joint, contact, fault, etc., measured from the horizontal. The dip is the maximum angle of slope of a given plane and is measured between that plane and the horizontal in a position perpendicular to the strike; see *Strike*.

*Disconformity.* See *Unconformity.*

*Dolomite.* A rock containing a significant quantity (over 50 percent) of the mineral dolomite, which is a carbonate of calcium and magnesium, $CaMg(CO_3)$.

*Drag fold.* See *Fold.*

*Fault.* A break in the continuity of a body of rock attended by movement on one or both sides of the break (the fault surface). The amount of displacement may be a few inches or thousands of feet. Faults are classified both as to type of movement and orientation with respect to the bedding.

*Strike fault.* A fault striking nearly parallel to the strike of the bedding cut by the fault.

*Cross fault.* A fault striking perpendicular to, or at a high angle to, the strike of the bedding cut by the fault.

*Tear fault.* A cross fault along which displacement has been parallel to the strike of the fault.

*Normal fault.* A fault in which the hanging wall has apparently moved downward relative to the footwall.

*Reverse fault.* A fault in which the hanging wall has apparently moved upward relative to the footwall.

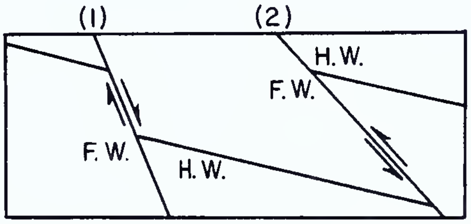

Figure 1. Diagrammatic cross section of normal and reverse faults offsetting a key bed. (1) Normal fault; (2) reverse fault; H. W., hanging wall; F. W., foot wall.[1]

*Stretch fault.* A thrust fault that occurs when the inverted limb of an overturned fold becomes so stretched that it finally ruptures (see *Recumbent fold*).

*Thrust fault.* A reverse fault; in common usage, a reverse fault having a low dip.

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[1] All figures in the glossary are from Gray, Carlyle (1952), *The high calcium limestones of the Annville belt in Lebanon and Berks Counties, Pennsylvania,* Pennsylvania Geological Survey, 4th ser., Progress Report 140, 17 p.

*Fold.* A bend in a surface or layer.

*Anticline.* An upfold or arch in the rock; may be small (inches) or large (thousands of feet).

*Axial plane.* An imaginary plane that divides a fold as symmetrically as possible.

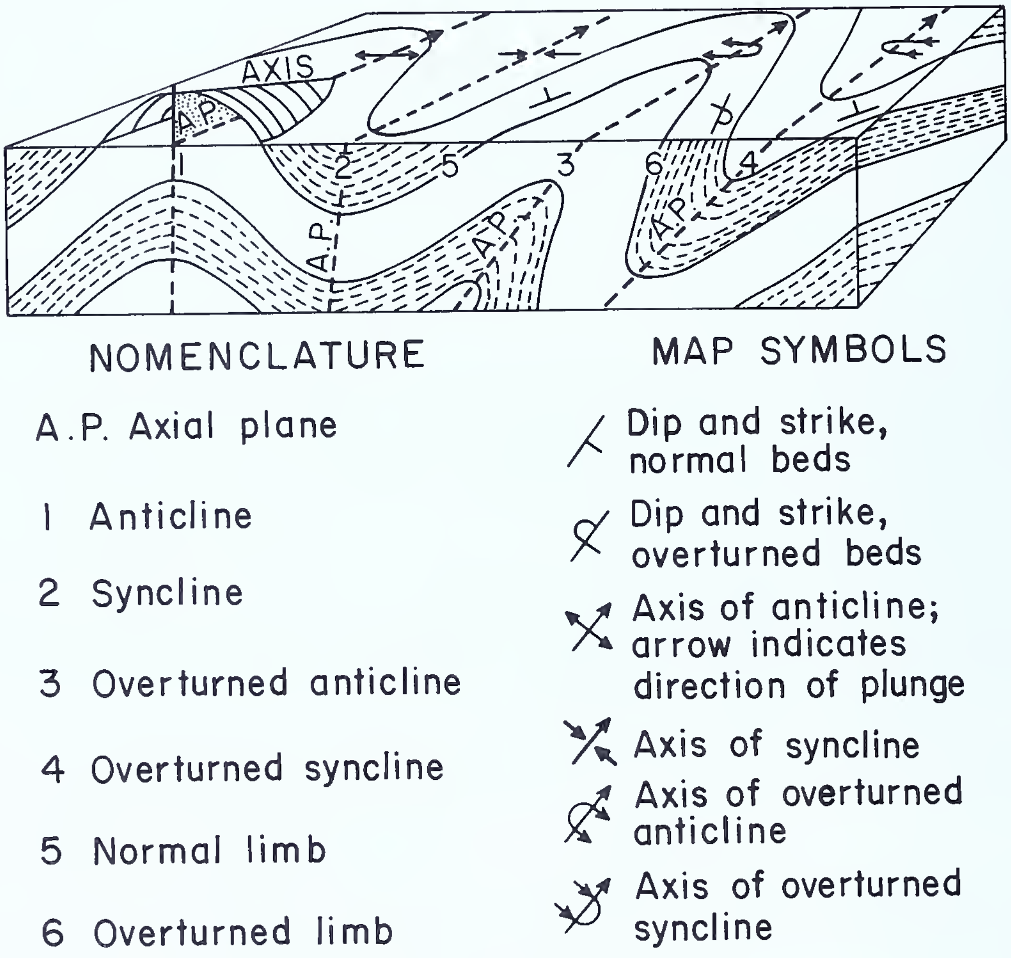

Figure 2. Fold nomenclature.

*Axis.* The intersection of the axial plane with a particular bed or with the surface of the ground.

*Crest.* The line of highest elevation on any bed in an anticline.

*Drag fold.* A fold produced in an incompetent (soft) bed by relative movement of two enclosing, more competent (stiff) beds in opposite directions with respect to one another (see Figure 3). Drag folds are usually of small size, a fraction of an inch to a few feet in amplitude. The term is also used in reference to larger folds formed by similar relative movement of enclosing rocks, as in an anticlinorium or overthrusting. Note in Figure 3, showing the relationship of drag folds to regional folding, that the axial planes of the drag folds are roughly parallel to the slaty cleavage. This relationship is useful in determining the top and bottom of beds. See *Cleavage*.

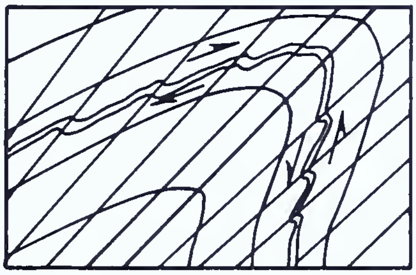

Figure 3. Diagram showing the relationship of axial-plane cleavage to bedding in an overturned fold. Also indicated are drag folds in an incompetent bed. Note that the axial planes of the drag folds are approximately parallel to the cleavage.

*Isoclinal fold*. A fold in which the two limbs dip at equal angles in the same direction; i.e., the limbs are parallel, or nearly so.

*Overturned fold*. A fold in which the axial plane is inclined and both limbs dip in the same direction, usually at different angles. One limb is right side up, whereas the other limb has been rotated more than 90 degrees and is upside down.

*Plunge*. The inclination of the axis of a fold as measured in a vertical plane containing the axis.

*Recumbent fold*. An overturned fold in which the axial plane is essentially horizontal; special terminology used in referring to recumbent folds is illustrated in Figure 4.

*Syncline*. A downfold or structural trough in the rock layers.

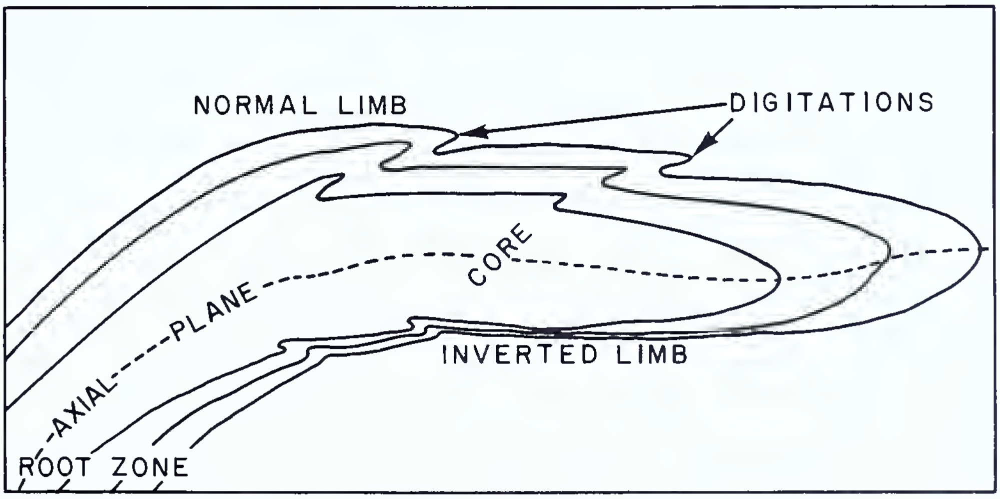

Figure 4. Nomenclature of recumbent folds.

*Formation.* A mappable layer or group of layers; the basic unit in geologic mapping. A formation must have recognizable contacts that are capable of being traced in the field, and it must be large enough to be shown on a map.

*Fracture.* A break in a rock caused by stresses.

*Gneiss.* A metamorphic rock in which bands of light-colored quartz and/or feldspar alternate with bands of dark-colored minerals.

*Igneous.* Rock formed from the solidification of magma.

*Intrusion.* A body of igneous (molten) rock that invades older rock.

*Isoclinal fold.* See *Fold.*

*Joint.* A fracture or break in a rock along which no movement has taken place (compare *Fault*).

*Leaching.* The differential removal of more soluble materials by the action of dissolving liquids; limestones are leached by groundwater, or even surface waters, especially those containing high concentrations of naturally occurring carbonic acid.

*Limestone.* A sedimentary rock composed predominantly of calcium carbonate ($CaCO_3$); other minor constituents may include the mineral dolomite, clay, silica, and, less abundantly, iron carbonate and sulfides.

*Impure limestone.* Contains more than 5 percent of insoluble impurities.

*Pure limestone.* Contains less than 5 percent of insoluble impurities, and less than 10 percent $MgCO_3$.

*High-calcium limestone.* Contains over 95 percent $CaCO_3$.

*Magnesian limestone.* Contains 10 to 30 percent $MgCO_3$.

*Lithology.* The compositional description of rocks.

*Mantle.* The layer of loose, incoherent rock material, of whatever origin, that nearly everywhere forms the surface of the land and rests on hard bedrock; it comprises rock waste of all sorts, volcanic ash, glacial drift, alluvium, wind-blown deposits, vegetal accumulations, and soils.

*Metamorphic rock.* Rock formed by the conversion of older igneous, sedimentary, or metamorphic rock in response to a change in temperature and/or pressure.

*Normal fault.* See *Fault.*

*Overturned fold.* See *Fold.*

*Plunge.* See *Fold.*

*Recumbent fold.* See *Fold.*

*Reverse fault.* See *Fault.*

*Sandstone.* A clastic sedimentary rock composed of mineral grains 0.2 to 2.0 millimeters in diameter.

*Schist.* A metamorphic rock that is foliated and splits into thin, irregular plates.

*Sedimentary rock*. Rock formed from the consolidation of loose sediment by cementation or compaction.

*Shale*. A laminated sediment in which the constituent particles are predominantly of the clay grain size; has fissility that is approximately parallel to bedding.

*Shear zone*. A zone in which the rock is crushed and brecciated as the result of movement on innumerable, closely spaced, more-or-less parallel fractures.

*Stratigraphy*. The study of rock strata, the conditions of their deposition, and their character, age sequence, and distribution.

*Strike*. The direction (azimuth) of a line formed by the intersection of an inclined surface (e.g., bedding, joint surface) and a horizontal plane. Compare *Dip*.

*Structure*. The configuration of rock formations as emplaced or as modified by folding, faulting, and the like.

*Syncline*. See *Fold*.

*Tear fault*. See *Fault*.

*Thrust fault*. See *Fault*.

*Unconformity*. A buried erosion surface. To form an unconformity requires a reversal of the condition of erosion and sedimentation; an area once eroded becomes one of sedimentation. The surface separating the newly deposited rocks from the underlying, partly eroded rocks is an unconformity. A disconformity is an unconformity between formations whose bedding is nearly parallel.

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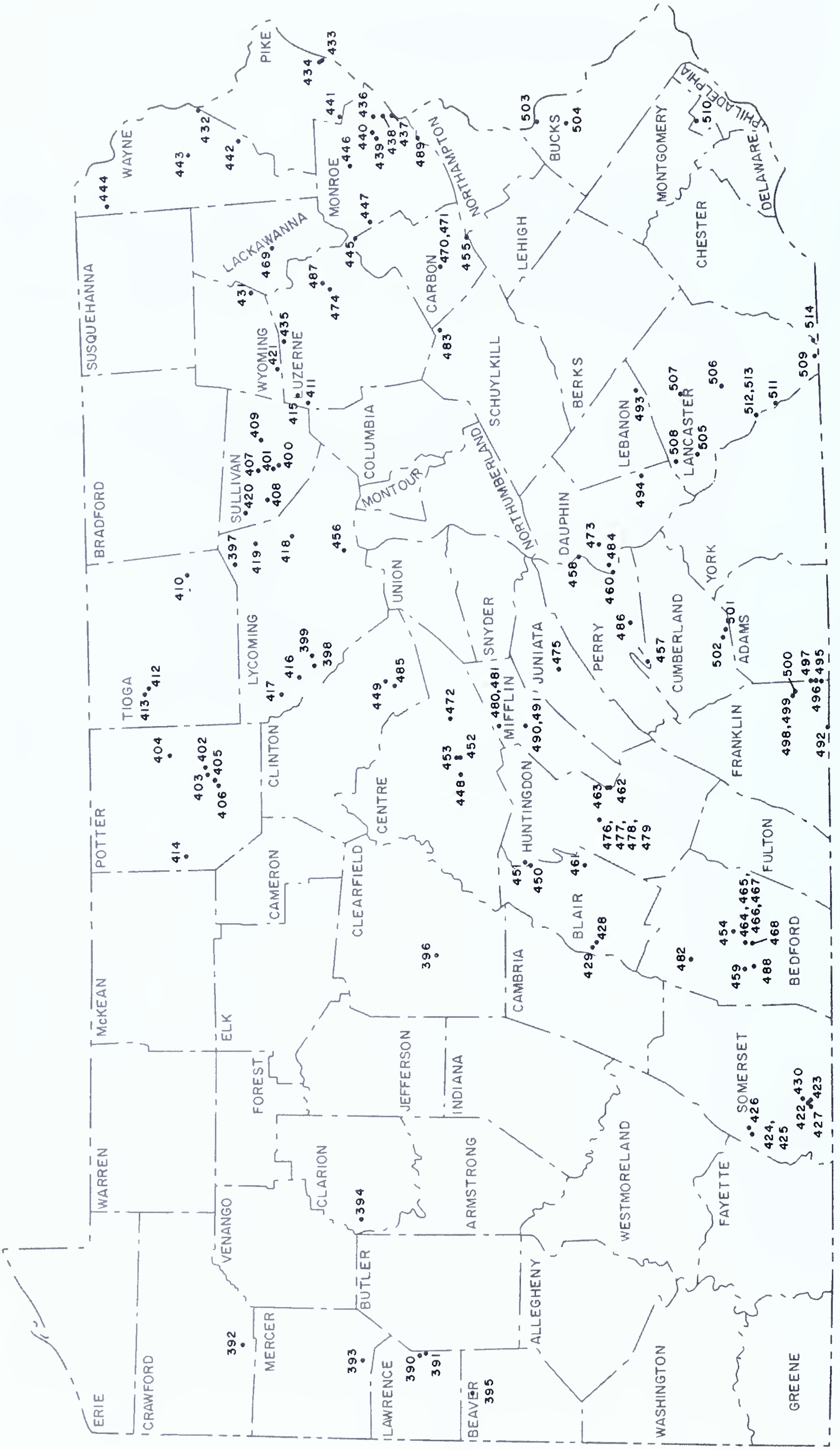
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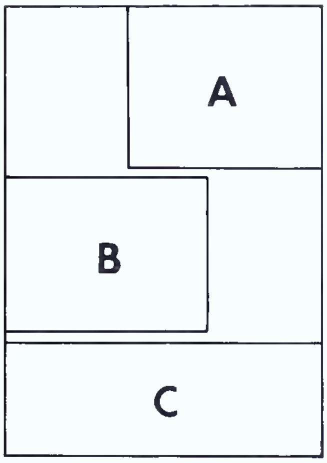

A. Prospect Rock (Luzerne County)
B. Buttermilk Falls (Wyoming County)
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